THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIII. No. 1603.] LONDON, JANUARY 30, 1894. [46TH YEAR. PRICE 6d.

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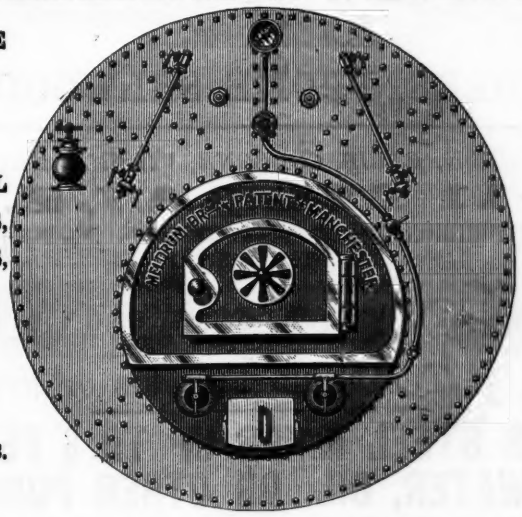

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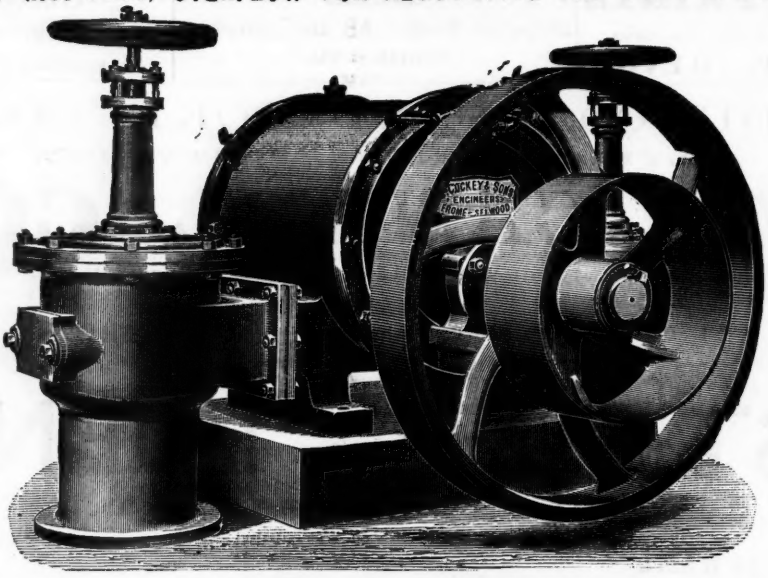

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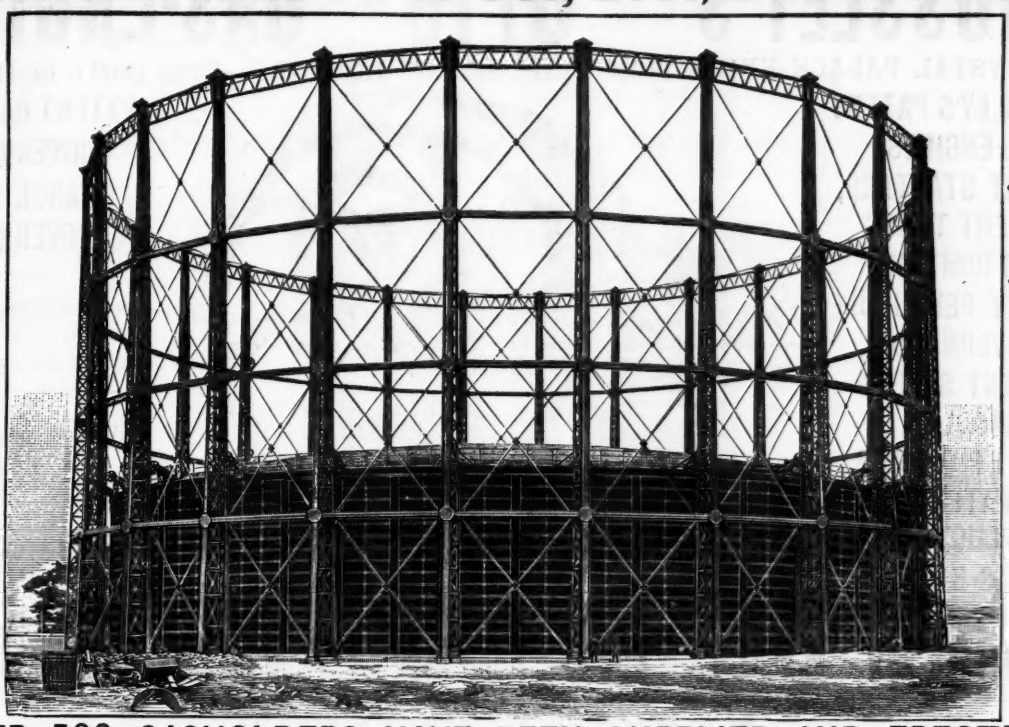

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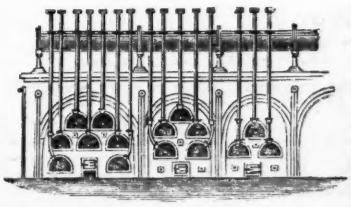

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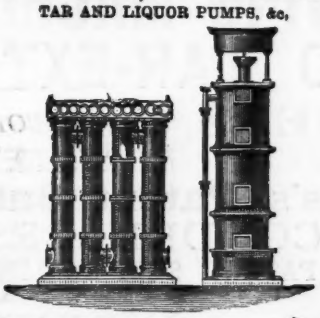

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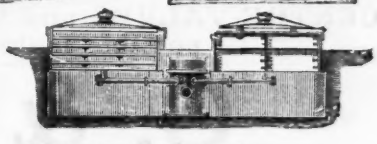

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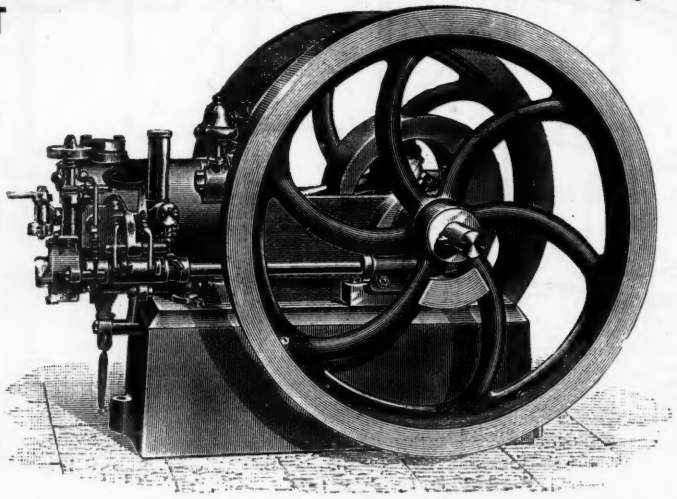

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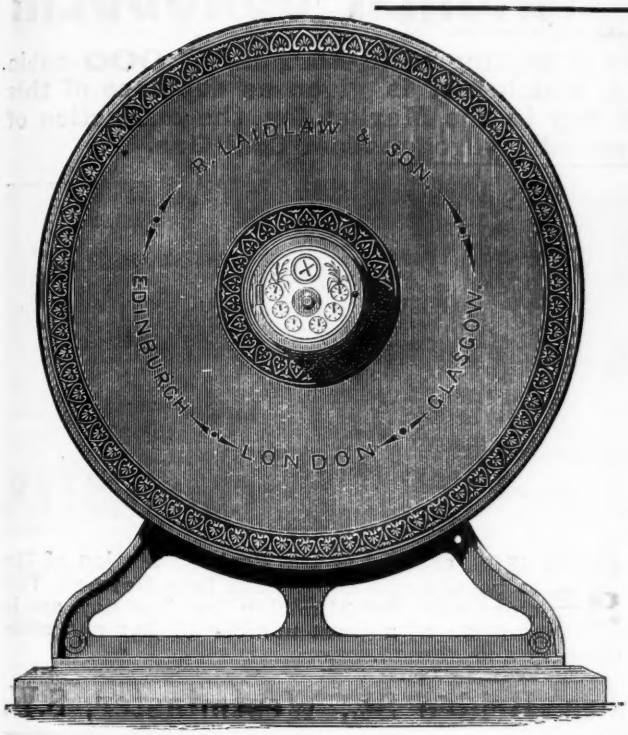

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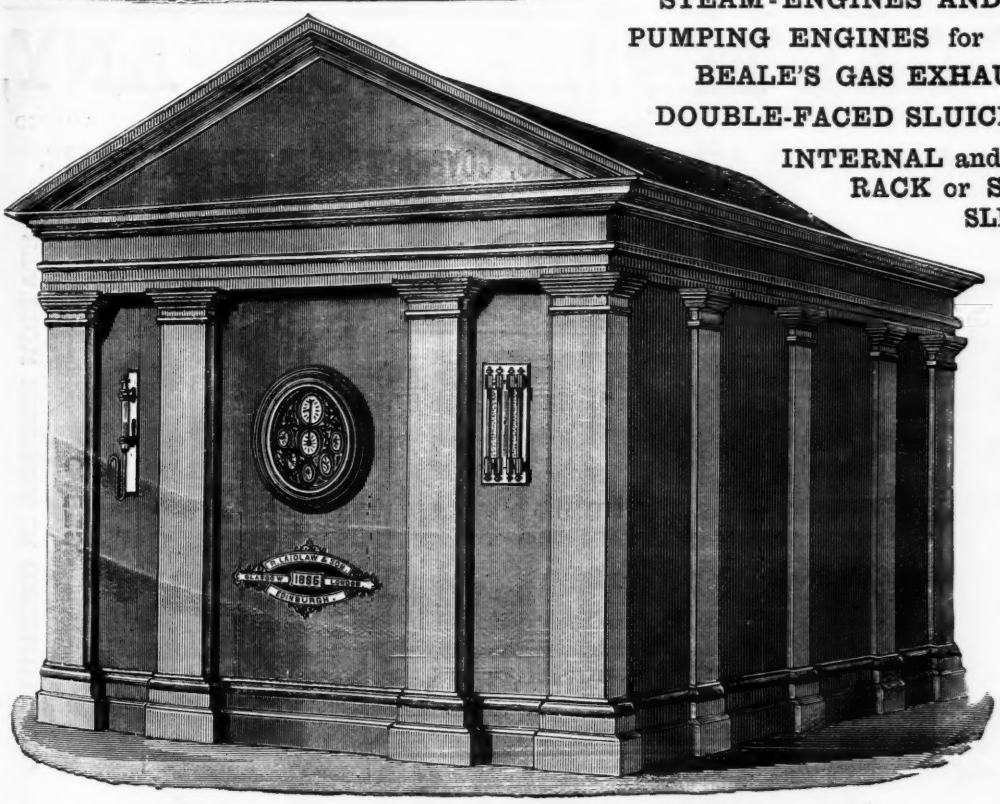

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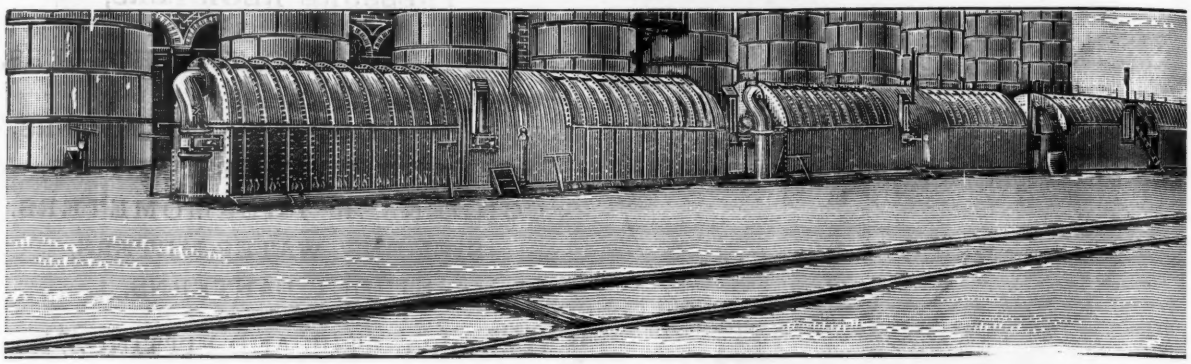

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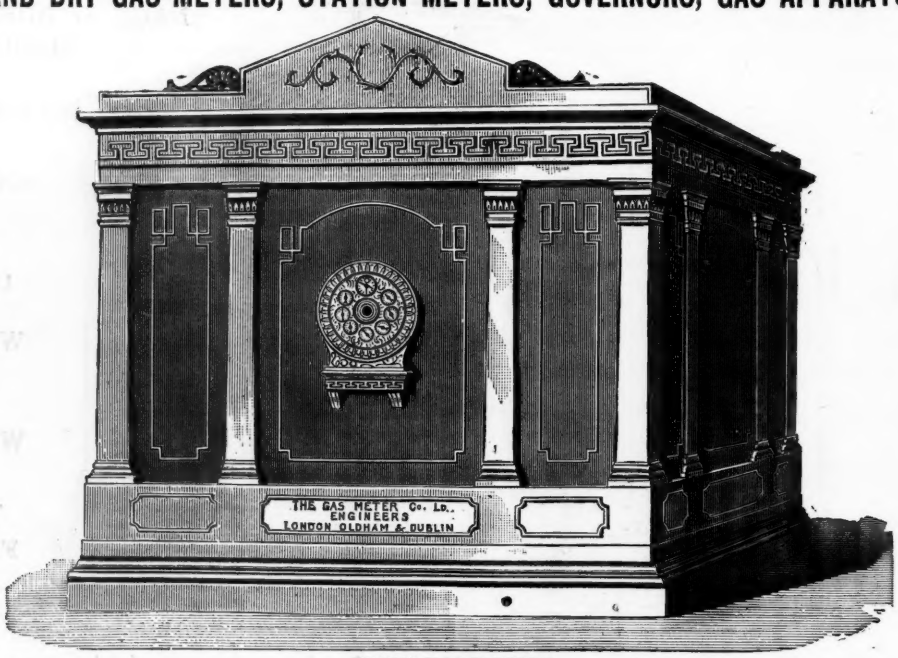

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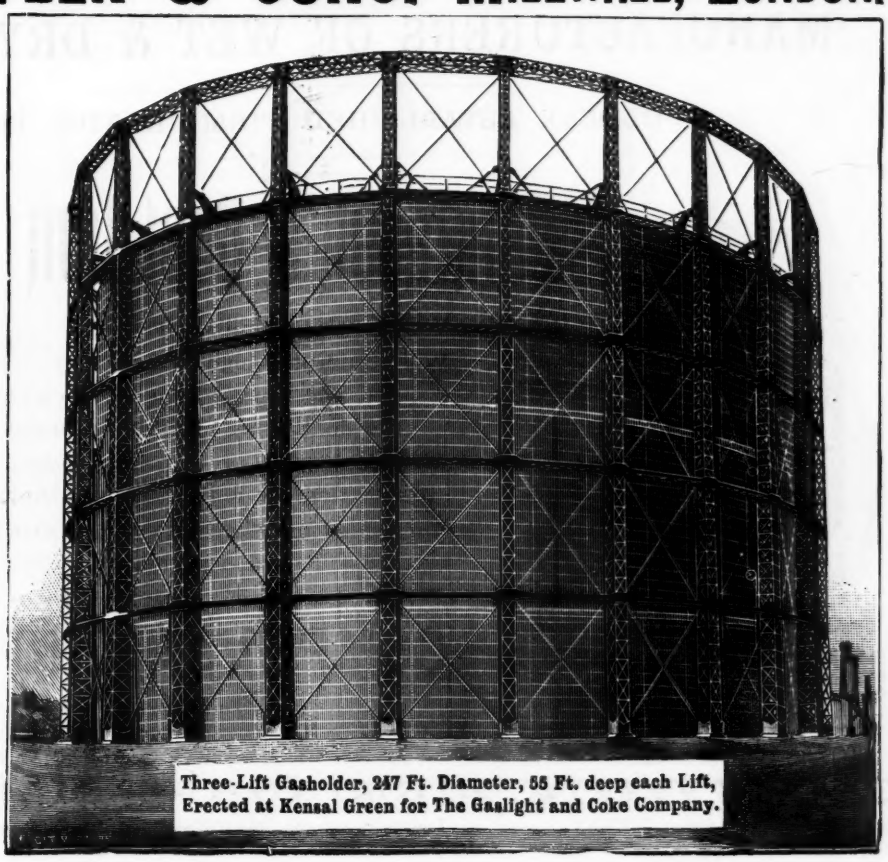

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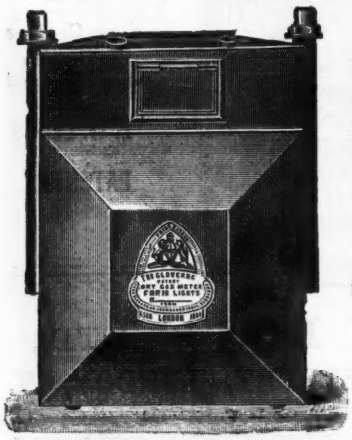

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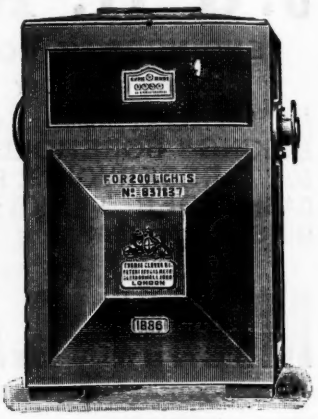

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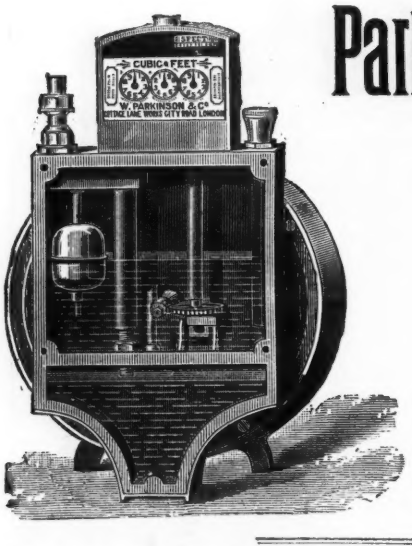

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JANUARY 30, 1894.

Lord Shand and the Conciliation Board.

THE announcement made public on Friday last, that Lord Shand had been asked by the Speaker to accept the onerous and thankless post of Chairman of the Conciliation Board of Coalowners and Miners, and had consented to act in this capacity, was one of the best pieces of news that has been lately heard in connection with the coal industry. Altogether apart from personal considerations, it was very satisfactory to learn that the last step in the formation of the Board had been taken, and that consequently there would be no constitutional obstacle in the way of starting the Board. But when the position and character of the Chairman are taken into consideration, as these points must naturally be envisaged from the instant of the promulgation of the appointment, it must be acknowledged that, humanly speaking, Mr. Peel's choice is perfect. Lord Shand is a Scotsman, an eminent lawyer, a sound judge, and neither a politician nor a controversialist. He is one of the most conspicuous of the living examples who show that Britain still knows how to esteem and reward with wealth and position men who do not go about "beating "the big drum" to call attention to their own excellences. If the Conciliation Board is ever to come to anything, Lord Shand is exactly the man to put it in the right way. Nobody can complain that the Speaker has failed to appreciate the dignity of the organization created by the Rosebery agreement. In asking one of the best men in the country to take the head of it, he has at once complimented the Board and taken the only precaution in his power for ensuring that it will justify its existence. It would be superfluous to argue at length in favour of the supposition that Lord Shand will know how to hold the balance evenly between the two parties on the Board. He may further be depended upon to prevent the Board being misused for the purposes of agitation, by persons who live by fishing in troubled waters. He will not have an easy task to perform even if, as *The Times* assumes, he is to be regarded as an Umpire rather than as a Chairman. Not the least of the difficulties that stand in the way of pacific solutions of the recurring troubles in the coal trade consists in the dual capacity in which most, if not all, of the men's representatives are, by their circumstances, forced to act. They represent working colliers; but inasmuch as they have mostly ceased to be working colliers themselves, and are practically bureaucrats in receipt of salaries greatly in excess of the pay of the working members of the class from which they sprang, they have their own interests to care for.

The truth of this matter is that the whole system is wrong under which the men who are members of Parliament and of County Councils and Local Authorities, and who receive high salaries in consideration of their public offices, still affect to speak and act as though they were day labourers. We believe in the principle of workmen sending their own representatives to Parliament, and to act on their behalf upon Boards of Conciliation; but the representatives should be actually members of the order which sends them before the public in its name. We have no faith in lodging-house keepers, publicans, or newspaper men posing as representatives of a working class which they either quitted the moment they had the opportunity of doing so, or to which they never really belonged. In what sense can a Trade Union official and professional politician who has not handled pick or shovel for a quarter of a century, while he has all this time been drawing £300 or £400 a year in pay and perquisites, be truly said to be a representative of Labour? He works, of course, and, as members of the class are fond of telling the world generally, the professional agitator who has to live by his wits and the power of the tongue and the pen probably works harder than the average day labourer. The fact remains, however, that he is no more a day labourer than any other scribbler or spouter who has succeeded in writing and talking himself into a paying connection in journalism or politics. If all professional labour leaders were paid neither more nor less than their working comrades, their position would be much stronger than it is now. Men who elect to serve their fellows by speaking for them, and organizing Unions in their name, are entitled to their "living wage." But so long as the estimate of what constitutes a fair "living wage" for a professional agitator so greatly exceeds that which has to suffice for a mere working man, so long will those clever individuals who succeed in obtaining the former rating for themselves lie under the suspicion of having personal interests separate from their asserted class obligations; and so long also will employers continue to regard them as undesirable intruders between masters and men. If the Conciliation Board comes to grief, despite all Lord Shand's care, the result will not be due either to the obstinacy of the workmen or to the unreasonableness of the colliery proprietors, but simply to the machinations of professional agitators whose occupations would be imperilled by the establishment of good relations between

employers and employed. It is to be hoped that Lord Shand will prove too hard a nut for these men to crack.

The Cry of the "Progressive."

It must be a very comfortable thing, one would suppose, to be a "Progressive," and to belong to the Progressive Party. It must be ever so much more inviting a state of existence than that desired by the typical good boy, who, as one learns by some lines that have come down to us from the improving literature of a past generation, was in the habit of remarking that he wished "to be an angel, "and with the angels stand." For in this case a certain amount of preparation was understood to be necessary; and as not all aspirants could "stay the course," the reward was somewhat uncertain. Now, however, we have "changed all that." So far as can be perceived by the most curious observer of the species, no qualification whatever, beyond the possession of illimitable self-conceit, is needed in a modern Progressive; and he has only to announce himself as a member of the Party to receive, in the various newspapers affiliated thereto, full credit for absolute infallibility, perfect wisdom, and supreme public virtue. If this picture of the state of the Progressive is thought to be overdrawn, it is only necessary to refer to any issue, taken at random, of certain newspapers that might, but shall not, be named, to show that it is, if anything, under-coloured. All that the Progressive asks for is to have his own way with the British Constitution, and with every industrial and social arrangement that has been established by the combined efforts of those who have gone before him. Then he would show the world something! In this declaration we may all unreservedly join, with a mental reservation on the part of most of us with regard to the character of the exhibition. For some time past the London Progressives have been turning their attention to the Metropolitan Gas Supply; and the following passage upon the subject, taken from a recent pronouncement of one of their organs, is worth quoting as a fine example of the "advanced" way of putting things. "To "a large extent," runs the statement, "we are indebted "to the Gas Companies for our light." There ought not to be much indebtedness, in the ordinary meaning of the word, on this account; but as the last quarter's gas bills, although delivered, are not yet paid, the statement is so far justified by the fact. Then follows this remarkable sentence: "The Gas Companies are indebted to us for "the amount of £1,037,118 6s. 2d., which they distribute "among themselves in dividends." It is obvious from this that Progressivism has a language of its own, which requires mastering in order that the teachings of the cult may be fully appreciated. It is easy to follow the drift of the statement in question when one recognizes that the word "indebted" has to be read in a peculiar sense, but without altogether abandoning its ordinary meaning. We are bidden to understand that the seller of a commodity is "indebted" to his customers for the profit, whatever it may be, earned in the course of his business. It is just that men should pay their debts; and so it necessarily follows that the retention of profits by a trader is an act of robbery. Can anything be clearer as a statement of the "advanced" views of industrial and commercial economics which are the glory of the Progressive Party? Nor is there anything strained in this interpretation of the passages; for it is the necessary extension of the doctrine known to be held by the Labour branch of the Party, that the workman has a right to the whole of the proceeds of his labour. Thus the world advances towards the goal of the time when it shall no longer be worth anybody's while to employ labour or sell an article, for the simple reason that he will not be paid for so doing. And the beauty of the Progressive position upon these and all other points of economic principle is that nobody who once takes to it ever entertains the smallest doubt about its correctness and sufficiency. Everything a Progressive does, or more often only talks of making somebody else do by the compulsion of an Act of Parliament, is dubbed an "advance." It never occurs to the people who use this language that their command may be like that of the legendary drill sergeant: "Advance "—two steps backward!" Meanwhile, those who watch the course of public life in these times may well wonder what will be the upshot of all this clamour, not merely with regard to gas supply, but also in respect of less purely commercial matters.

An Eminent Professor and an Obscure Periodical.

There has been some very pretty "sparring" in the correspondence columns of our contemporary *Nature*—which, by the way, has greatly improved of late—over Professor Smithells's lecture on "Flame," which was recently reproduced in the Journal. The combatants were Professor Smithells himself and Professor H. E. Armstrong. It is not our intention to offer here any remarks upon the subject-matter of this controversy, in which, as it appears to us, Professor Armstrong came off "second best." But this same eminent Professor deigned, in the course of one of his letters, to refer to the Journal—only, however, to describe it as "an obscure publication;" and this reference calls for some notice at our hands. It should hardly be necessary to remind students of the interactions that take place in flames, of the value of Professor Frankland's observations on the subject, which were given to the world in the form of Royal Institution lectures in 1868; and these lectures were reported at the time in the Journal, and in no other periodical whatsoever. For reasons which we venture to surmise are not unconnected with the difficulty of the subject, Professor Frankland's work rests suspended where he left it; and all recent investigation of flame has proceeded upon other lines. Professor Frankland's work has not been ignored or forgotten, however; for Professor Lewes referred to it in his recent Cantor Lectures at the Society of Arts, Professor Smithells commented upon it in his British Association lecture, and other evidence might be adduced not only to show that it has lost none of its interest, but also to prove that, however "obscure" the publication which reported it, the sound of it has gone out into the world. It was therefore quite superfluous in Professor Armstrong to pat Professor Frankland on the back in that brilliant periodical *Nature*, by graciously admitting that it had always appeared to himself that "Frankland's arguments "are of a most weighty character." And there is likewise no real justification for the observation that follows this piece of professorial condescension—"that, owing to their "appearance in an obscure publication, they have never "yet been sufficiently widely considered." Opinions may be allowed to differ as to what constitutes obscurity in a periodical; but we have the comfort of knowing that but for the Journal a good deal of scientific work done *circa* 1868, and long before that year, and not only by Dr. Frankland, would not have been recorded at all. How many periodicals were there in existence twenty-five or thirty years ago that would have gone to the expense and trouble of reporting Frankland on "Flame"? It is evident that Professor Armstrong's education has been sadly neglected in regard to the character of the technical periodicals of the last generation. It was certainly not strange for the Journal of that period to report Dr. Frankland, inasmuch as it constantly reported many other good workers, whose labours the younger race of scientific men dare not ignore. We have no *animus* against Professor Armstrong for having written disparagingly of the Journal as a medium for disseminating scientific intelligence; and we are content to be called "obscure" by him so long as a fair number of people find our columns useful. Nay, we are quite prepared to heap coals of fire upon Professor Armstrong's head, and hereby engage that the first time he does or says anything capable of being regarded as interesting or useful to our readers, we will extend to him his fair share of the same obscurity that has helped to keep green the remembrance of Dr. Frankland and many others who laboured before the sun of Armstrong had arisen on the scientific horizon.

Mr. Clare on Municipal Finance.

The lectures now being given before the Institute of Bankers by Mr. George Clare, on the subject of "Cor-"poration Stocks," the first of which was noticed in these columns a fortnight ago, are important contributions to the critical literature relating to the working of British Municipalism, which is not too voluminous. One hears a vast deal of eulogy of the principle of local self-government; but the manner in which the principle has been applied in the actual practice of municipalities is not often passed in review by competent authority. In taking the financial aspect of these matters under impartial investigation, Mr. Clare has done a real public service; and it is to be hoped that the necessarily arid character of his addresses will not stand in the way of their being

attentively studied by those who are anxious to serve their generation loyally in connection with municipal administration. In his second lecture, Mr. Clare analyzed the local debt; showing that 94 millions of it, or nearly one-half, is really the outstanding balance of money that has been borrowed by local authorities for investment in self-supporting trading undertakings, such as water-works, gas-works, docks, markets, tramways, &c.; that of the remainder, no less than 37 millions has been laid out upon buildings of various descriptions, ranging from town halls, schools, and public libraries to lunatic asylums, gaols, and slaughter-houses, most of which, if not purchased, must have been rented; and that only the residue of 70 millions, spent upon sewerage, street improvements, parks, &c., can be described as dead weight. The lecturer pointed out that the debt outstanding for the trading undertakings of our municipalities is not their present value, but represents the cost, less repayments; and he observed that, although no general local balance-sheet has ever been drawn up, it is certain that the actual worth of the profit-earning assets enormously exceeds the proportion of the debt by which these are represented in his statement. This is conspicuously the case, it may be remarked, in respect of the gas undertakings, which are worth several times more than the figure at which they stand in the Board of Trade returns. Against the dead-weight liabilities for sanitation and improvements must be set off the public gain in health and happiness. It is refreshing to hear such a statement as this; and most people will agree that when a large corporation spends money in the purchase, say, of a good picture for the local art gallery, the outlay is for a worthy object. With regard to the prospects of the future growth of municipal indebtedness, Mr. Clare takes the reassuring view that the unproductive debt has almost attained its maximum, as the operation of the sinking funds ought soon to outpace the fresh borrowing; but he expects the productive portion to still largely increase. Mr. Clare took note of the apparent determination of the larger corporations to be some day absolute masters of their own streets, and their disposition to acquire all undertakings, such as tramways, gas, water, hydraulic power, electric light, and so forth, which meddle with, or claim a partial monopoly of, the public thoroughfares. As to this programme, Mr. Clare confined himself to remarking that, while as an aspiration it might be laudable, its full realization, should it come to pass, would mean "the addition to "local indebtedness of untold millions." As to whether this eventuality is to be desired or otherwise, Mr. Clare said nothing; but there does not appear to be any particular reason, from the financial point of view, why the prospect should be regarded as alarming. Indeed, there must be fresh opportunities provided for the investment of the savings of the people; and on this account it may be expected that municipal finance will have a tendency to enlarge rather than to contract its scope.

An Award of Sir F. Bramwell.

THE arbitrariness of arbitrators was curiously illustrated by a case heard last week by Justices Mathew and Collins, in which the London Street Tramways Company appealed against the award of Sir Frederick Bramwell as to the value of tramways which the London County Council are purchasing under the terms of the Act of 1870. According to this Act, the Metropolitan Board of Works (whose powers have been inherited by the County Council) could, at a certain time, require the Company to sell their undertaking, upon terms of paying the then value—exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory sale or other consideration whatsoever—of the tramway, and all lands, buildings, works, materials, and plant of the Company suitable to, and used by them for, the purposes of their undertaking. When Sir Frederick Bramwell sat as Referee to determine the value of the tramway in accordance with the Act, the Company proposed to tender evidence of the actual profits made by them from carrying it on; and they claimed to be paid for their property as a going concern. To this method of valuation, the County Council objected; and the objection was allowed. Thereupon the Company tendered evidence to show the value of the property as a hereditament that could be let to a hypothetical tenant. Again, the County Council objected, and again they carried their point; and eventually the Arbitrator awarded to the owners merely the structural value of the tramway, with which, of course, the Company were not satisfied. The judgment of Justices Mathew and Collins was to the effect that, as the statute referred to the "undertaking" as the subject of the purchase, it must be the undertaking that the Arbitrator ought to value, and not merely the materials of a tramway *in situ*. Consequently the award was remitted to the Arbitrator, in order that he might revalue the undertaking upon the basis of the rental; but it was left to him to find what was the rental, and how many years should be taken. The judgment seems to be a just one, if there is any meaning in the term undertaking; and it is interesting as an example of the clear understanding of an Act of Parliament by the Court, which is not always exhibited. It is difficult to see how Sir Frederick Bramwell could have been so misled as to have adopted the County Council view that the word "undertaking" signifies no more than the structural means and materials for carrying on a statutory business.

WATER AND SANITARY AFFAIRS.

THERE is one important particular in which the Thames Conservancy Bill of the coming session is clearly at variance with the Bill promoted by the Southwark and Vauxhall Water Company, and in like manner is out of harmony with the report of the Royal Commissioners. The fifth schedule to the Conservancy Bill sets forth the maximum quantity of water which may in future be daily taken by the Companies drawing from the Thames. The quantities thus specified in the case of the Metropolitan Companies are simply the same as those already authorized. The volume allowed being less than half the quantity contemplated by the Commissioners as likely to be required from the Thames at the end of forty years, it is obvious that the figures cannot stand. The main question is at once raised by the Bill of the Southwark and Vauxhall Company, which is avowedly framed for the purpose of carrying out the suggestions of the late Commission. If three-quarters of a million sterling are to be expended in works of storeage, subsidence, and filtration, the Company must have at command a corresponding quantity of water, which they certainly would not have if restricted to the present scale. We hear that, in the opinion of a high authority, the scheme of the Southwark and Vauxhall Company is of such magnitude in relation to the Thames as to require a distinct debate in Parliament. But the Company have a strong position, as working on the lines of the Royal Commission, and doing this not only in respect to the volume of water to be taken, but in regard to the regulations to be observed in the abstraction. A mere arbitrary rule as to the quantity of water which a Company may take is no longer suited to the exigencies of the case. The more reasonable and practical method is to settle the quantity to be drawn according to the *régime* of the river; and in this respect the Southwark and Vauxhall Bill provides a plan of working which is infinitely preferable to the one hitherto pursued. There are times when the river can give very little water, and there are times when it can supply very much more than is wanted. It is now proposed that the Southwark and Vauxhall Company shall take as much water from the Thames as they may require, but that they shall simply share with the other Metropolitan Companies in taking a supply which shall never reduce the flow over Teddington Weir to less than 200 million gallons per day. So long as the minimum flow of the Thames does not fall below this point, no harm will be done. Neither is that point likely to be often reached. In the case of the Southwark and Vauxhall Company, there will be a huge reservoir to store the water when the flow is ample, and to send it on to the consumer when there is a drought. There need be no fear of any muddy foreshore. The new weir at Richmond will help to make matters safe in this respect; and the specified minimum at Teddington Weir will complete the guarantee.

The formation of an "Upper Thames Defence Com-"mittee" is an inevitable result of a measure like the Thames Conservancy Bill, which touches a variety of interests, and enters to some extent on fresh ground. The provisions of the Bill with regard to pollution comprehend the whole course of the tributaries; the language employed

being such as to cover the entire "catchment area of the "Thames," exclusive of the Lea. At this rate, the jurisdiction would run up to Banbury, whence the Cherwell flows on its way to a junction with the Isis. Every rivulet around Banbury sends its tribute to the Nore, and is to come under the notice of the Thames Conservancy Board. The Defence Committee approve the main object of the Bill; but especial objection is taken to the proposed reconstruction of the Conservancy Board—four representatives of the five upper river counties being deemed seriously insufficient. The question of representation presents itself in one form on which the Defence Committee are silent, but which must clearly be brought forward. The Metropolitan Water Companies, who furnish a large proportion of the Conservancy revenue, and who are to contribute more than half as much again under the new scheme, if legalized, are left without any representation. If the London County Council may be represented to the extent of five members. although liable to be prosecuted by the Board if permitting any fouling of the river from the main sewers, there can be no reason why the Companies should not be represented, despite the remote possibility of some legal conflict between one or more of them and the Conservators—an event which we do not remember to have taken place in the past. As directly interested in preserving the purity of the river, the Companies who draw a supply from the Thames would appear to be specially qualified for service on a Conservancy Board. With respect to the riparian counties, these are rather interested in being allowed to act more or less after their own will and pleasure in their treatment of the stream. As to the extended jurisdiction proposed by the Bill, there is much to be said in its favour, as recognizing a physical boundary instead of one entirely artificial. But large towns like Oxford, Reading, and Croydon, are not likely to be pleased with the prospect of having their streams dealt with by an authority in whose deliberations they take no part. At the same time, the enlarged jurisdiction over the tributaries sought by the Conservators is simply designed for the prevention of pollution, for which purpose such extension seems only reasonable and right.

The judgment given in favour of the East London Company, in the Queen's Bench Division, last Friday, while establishing a valuable precedent, has a broad bearing on the question of an adequate supply of water in times of drought. So far as the merits of this particular case were concerned, the conclusion arrived at by the Lord Chief Justice, and concurred in by Mr. Justice Day, was very emphatic. The decision of the Magistrate at the Thames Police Court, that the failure of the supply at Morrison's Buildings last August was due to unusual drought or an extraordinary consumption of water, and that therefore the Company were exempt from penalties, was strongly upheld by the Court; and the appeal against the magisterial decision was dismissed, with costs—Lord Coleridge remarking that, while he did not wish to say anything at all hard, it struck him that "this was a "slightly vexatious attack on the Company." This is somewhat pronounced for a Judge; and yet something more remains to be said. In its rejection of the East London Company's Bill last March, in defiance of all remonstrance, the House of Commons took a direct step to prevent the introduction of an enlarged supply of water into the Company's district. It is to be hoped that, when the East London Company's project for extending their works in the Lea Valley comes before Parliament this year, our legislators will pursue a wiser course than on the former occasion. The same principle applies to the Bill of the Southwark and Vauxhall Company. A sufficient supply means adequate works.

Society of Engineers.—The first ordinary meeting of this Society for the present year will be held at the Westminster Town Hall on Monday, the 12th prox., when the Past-President (Mr. W. A. Valon, J.P.) will present the premiums awarded for papers read last session, and his successor in office—Mr. G. A. Goodwin—will deliver his Inaugural Address.

The Incorporated Institution of Gas Engineers.—We have received from the Secretary of the Institution (Mr. T. Cole) the *agenda* for the annual general meeting, which will take place on the 10th prox. As usual, only formal business will be transacted; and after the election of the officers, it is proposed to adjourn the meeting until the 9th of May, at the Institution of Civil Engineers, Great George Street, S.W.—the Council of this body having granteed the use of their hall on that date.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 209.)

THE favourable tendency on the Stock Exchange, upon which we remarked in our last issue, has been well maintained during the week just closed. Taking the markets all round, the aggregate of business done does not perhaps exhibit any material increase. But there was a better feeling; and prices in many departments made some improvement. The chief interest centred in home rails, in which further favourable dividend announcements, reaching in some instances far better proportions than had been anticipated, have caused a general advance all along the line. But while there has been almost a "boom" in some stocks, it does not necessarily follow that the public are rushing in to invest in them; and it is more than probable that a considerable proportion of the buying has been done by operators for the fall who have been caught short of stock. So the "bulls" have got an innings, for which they have waited a very long time. In other departments, there was not much to interest, though foreign affairs promised at one time to be rather exciting; and prices generally are steady. The Money Market was firm; and there was plenty of employment for money at market rates. The Bank of England still keeps up its 3 per cent. rate. Business in the Gas Market showed a barely average degree of activity; and firmness was the general characteristic. Most of the changes noted in quotations are for the better; and those which are in the opposite direction are attributable to special causes. In Gaslights, there were moderate dealings daily in the "A" at slowly improving figures, till the price of 238¼ was reached; but the latest transactions were a shade lower. The quotation, however, closed at an advance. The secured issues were in fair demand at firm figures. South Metropolitans were quiet, but strong; and the "B" advanced in value. Commercials were little dealt in; but they realized good prices. Among the Suburban and Provincial undertakings, both Alliance and Dublin issues were higher; and Bromley 10 per cents. were brought to notice again, with a nice improvement. Of the Continentals, Imperial were largely dealt in, and still at falling figures; but the rest were scarcely touched. There were no variations in any of the other undertakings, except Bombay, which fell another ½. Water Companies were remarkable only for frequent dealings in New River, which received quite a fillip from the Mart sale about three weeks ago, when very high prices were attained Several stocks made fair advances.

The daily operations were: The Gas Market was quiet on the opening day; and few stocks were touched but Gaslights and Imperial Continental. Alliance and Dublin 7 per cents. rose ½. In Water, Lambeth and New River gained 2 each. There was not much improvement in point of activity on Tuesday; but prices were very firm, except for Imperial Continental, which fell 1. Alliance and Dublin 10 per cents. advanced ½. New River improved 3; and Grand Junction, 1. Wednesday's prices for almost everything were very good; but Bombay receded ½. Thursday's transactions were only limited; but general firmness ruled. Gaslight "A" and South Metropolitan "B" rose 1 each. Friday was more brisk, with good prices for all but Imperial Continental, which fell 2. South Metropolitan "B" gained 1 more. In Water, East London, Grand Junction, and Lambeth rose 1 each. Saturday was fully as active as any other day, and quite as firm; but quotations remained without further change.

ELECTRIC LIGHTING MEMORANDA.

Electricians' Opinions Respecting Street Explosions—Newspaper Printing by Electricity—A Characteristic of the Metropolitan Public.

IT is not to be wondered at that the subject of the street explosions that have accompanied the development of underground electrical distribution in England and Scotland should have considerably impressed newspaper writers and the public generally. It is not at all pleasant to reflect that an additional danger has been created for the special discomfiture of those whom business or pleasure leads to brave the already multitudinous risks of the streets. The matter has been taken up by the *St. James's Gazette* in the fashionable style, according to which somebody has to be "interviewed" whenever a difficulty occurs in the working of our modern civilization. In this case, as might be supposed, the gentleman with the note-book went to the first electric light engineer he happened to think of; and, having collected the opinions of several of these not wholly disinterested parties, he reported that "we need not, after all, have very much fear of being blown to smithereens by electricity whenever we take our walks abroad." Of course, all the electricians consulted on the subject agreed that the blame for these street explosions must be put upon the gas. Their theory is that the earth of the streets has become saturated with gas that has leaked from the mains. This gas is supposed, in the course of its wanderings to and fro in the earth, to find out the electric cable culverts, and through them gain access to the

junction-boxes, where it forms an explosive mixture with the air. Then, given the coincidence of a corresponding leakage or spark from the electric current in this particular box, the result is ignition of the mixture and an explosion. Two electricians, including Major Flood Page, of the Edison and Swan Company, referred to the historic Tottenham Court Road explosion, in which the reporter thinks a "gasometer" was involved; and even the generally well-informed Major Flood Page blundered in speaking of this disaster, which he described as "an example of the evils arising from the impregnation of the ground by escaped gas." Seeing that this deplorable catastrophe occurred before the electric lighting industry was born, the least that electricians who endeavour to use it for "pointing a moral" might do would be to refrain from "adorning the tale" with misrepresentations of the facts. To return to the statements of the electricians with regard to the share of gas in street-box explosions, however, we may be permitted to remark that it is hardly fair to blame one element of a mischievous combination for all the injury resulting from it. We agree with the electricians in holding that the consequences of these explosions are not likely to be very serious; but they are quite capable of giving a great deal of trouble to everybody who can, by hook or by crook, be made responsible for their occurrence. The most disturbing accidents in connection with electrical distributions are, after all, those which the artful electricians led the *St. James's Gazette* reporter to overlook—we refer to the Bournemouth class of accident, in which there is no explosion, but a dangerous, and sometimes fatal, shock. Not a word is said of these in the reported interviews; but the statement has been made by authority that the Board of Trade are just now carefully considering the subject.

One of those little incidents that strike the public imagination almost as powerfully as the spectacle of the lid of a street junction-box sailing through the air, as the result of the "coincidence" of an explosive gaseous mixture and an electric spark in the street conduit, is the announcement that a couple of London evening newspapers are now printed by electric power. We are quite ready and willing to give the one incident as full prominence as the other. The facts appear to be that the *Globe* drives its eight linotype composing machines by electric motor, at that time of day when the main steam-engine is not working. This is intelligible, for the composing department is most busy when the printing machinery is not running; and so the employment of electricity in the composing-room is likely to be an economy as compared with the use of a large steam-engine for some hours at only a small fraction of its capacity. The case is different with the *Pall Mall Gazette*, the other journal in question, which has set up two 40-horse power motors of the Manchester type for doing the actual printing of the paper. So far it is stated that the sudden starting and stopping of these machines, taking as they do a large quantity of electricity, has not been observed to make any appreciable difference in the lighting of the district served by the same mains, which are those of the Charing Cross and Strand Electricity Company—a low-tension undertaking using the three-wire system, and distributing at a pressure of 200 volts. This experiment may be satisfactory to the Company; but we should have thought that an uncertain, heavy load of this character would be the last thing an electric lighting company would desire. It might be different in the case of a morning newspaper, which would only require the power late at night after the heaviest lighting load was off; but an evening newspaper, often requiring to print heavy special and "extra special" editions at the very hour when the lighting load is coming on, and perhaps in the middle of a dense fog, can hardly be an ideal customer for electric power. Naturally, the electricians desire greatly to increase the day load on their central station plant, as a means of improving their revenues; and, generally speaking, the extension of power transmission by electricity is a laudable object which the success of special experiments of the kind now in question is calculated to further. It is obvious, however, that it must need a large steam power station and a wide-awake superintendent to bear such great and irregular strains as would ensue from the multiplication of customers like the *Pall Mall Gazette* printing office. This class of business can hardly pay, save as an advertisement; and we shall wait with some curiosity to see how long the legend "Printed by Electricity" is borne on the forefront of our admired evening contemporary.

There is a notable difference between the way in which London regards such matters as that just discussed, of the introduction of electrical power into printing offices, and that in which the American, and even some British provincial public take the same things, or are led to take them by the parties interested. The Metropolitan public are slightly tickled at first by the idea of reading an electrically printed newspaper, just as the same people were by the notion of travelling from Stockwell to the City by an electrical subway. Such impressions are, however, very transient, and immediately yield to the permanent consideration of how the work or service, whatever it may be, is done. If a City chop-house were to announce that all the cooking would for the future be done by electricity, the statement would hardly arouse a gleam of interest, unless it could be shown that the cooking was improved. Not a single shop will attract a single additional customer by the circumstance of its being lit by electricity; the only permanent attraction in this kind being the effect produced. The average Londoner, in short, cares not a straw how things are done, or who does them, so long as they suit his purposes. His curiosity takes account, as a rule, only of results and effects; and he is apt to resent as an impertinence any attempt to interest him in the agency rather than in the performance.

WATER BILLS FOR 1894.

In the JOURNAL last week (p. 147), we noticed the Water Bills for the ensuing session promoted by Companies, together with the Bill of the London County Council. We now deal with those of Local Authorities.

The Abertillery Local Board (Gas and Water) Bill is to enable the Local Board to acquire part of the undertaking of the Brynmawr and Abertillery Gas and Water Company. The Company obtained their last Act in 1892, when they were authorized to increase their capital and construct enlarged water-works, which have not yet been commenced. An agreement for the sale to, and purchase by, the Local Board of so much of the water undertaking of the Company as is within their district, has been concluded, and is inserted in a schedule to the Bill; but it is desired to vary the original terms, and reconsider the plans for enlargement of the works sanctioned in 1892. The Local Board desire to borrow £22,000 for purchasing the severed portion of the water undertaking, and £30,000 for new works. These are all to be situated in the parish of Aberystruth, in Monmouthshire; and they comprise a reservoir to be formed by impounding the Tillery Brook (otherwise known as the Afon Tilerau) and the necessary subsidiary works, to be completed within seven years. Certain water-works authorized by the Company's Act of 1892 are to be abandoned, subject to compensation. The Accrington Gas and Water Board Bill is to constitute and incorporate a Gas and Water Board for the borough of Accrington and the districts of the Local Boards of Church, Clayton-le-Moors, Great Harwood, and Rishton, in Lancashire; and to transfer to and vest in such Boards the undertaking of the Accrington Gas and Water Works Company. The Company's water capital consists of £134,000, with £29,600 of 5 per cent. debenture stock. The consideration for the transfer is fully set out in a scheduled agreement, dated Sept. 30, 1893. In the constitution of the Board, eight members are to represent Accrington, with two from each of the Local Boards—Accrington to supply the Chairman so long as the rateable value of the borough exceeds that of the aggregate Local Board districts. An undivided lump sum of £5000 is to be borrowed to pay to the Company; and £56,000 is required for the purposes of the water undertaking. The water revenue is to be applied in the usual way, with the proviso that any surplus is to go to the reduction of the charge for water for domestic purposes when circumstances shall permit the same to be done.

The Bacup Corporation Water Bill is to authorize the Corporation to acquire the undertaking of the Rossendale Water-Works Company, in accordance with the terms of a scheduled agreement. The paid-up capital of the Company is £26,876; and there is a mortgage debt of £6870. It is desired to borrow enough money to pay off the debt, and likewise a sum of £7000 for the purposes of the undertaking. Surplus revenue is to be applied in reduction of the rates for domestic supplies. The Barnsley Corporation (Water) Bill is to enable the Corporation to purchase the water-works of the Penistone Local Board, in order to increase the capacity of their own undertaking; and the terms are set out in a scheduled agreement, by which it appears that the price to be paid is not to be less than £20,000, nor more than £24,000, as determined by negotiation or arbitration. The purchase is to be conditional on the Penistone well yielding at least 400,000 gallons of water per day for six consecutive days, as tested by pumping-engines now being fixed. The Penistone Local Board are to have a supply for their district at the rate of 4d. per 1000 gallons up to the date of their obtaining a separate source of supply. The Barnsley limits of supply are to be extended; and their relief tank in the township of Hoyland Swaine, in the parish of Silkstone, is to be connected by a pipe-line with the Penistone source at a point near Penistone Bridge. The sum of £30,000 is to be borrowed for the purposes of the Bill. Among the applications of water revenue, there is recited, as lastly, the payment of any charges or expenses for the time being payable out of the general district rate or otherwise for the public benefit of the inhabitants and improvement of the borough.* The Kendal Corporation Gas and Water Bill is to authorize the transfer of the undertaking of the Kendal Union Gas and Water Company to the Corporation, in accordance with the terms of a scheduled agreement. The sum of £90,200 is to be paid over to the Company, and £28,800 for the purchase of land and the construction of new water-works. The new works comprise a reservoir to be called the Fisher Tarn reservoir, to be formed by impounding the water of the Beehive Beck, discharging compensation water from the same

*These were the original proposals of the Corporation; but, as will be seen by a paragraph which appears elsewhere, the Bill has now been dropped.—ED. J. G. L.

at the rate of not less than 42,000 gallons per day of 24 hours in a regular and continuous flow. The rate for domestic supplies is to be 7½ per cent. on the rateable value, with an extra charge of 5s. for every water-closet beyond the first, and 10s. for every fixed bath.

The Neath Corporation Water Bill is to authorize the Corporation to acquire the undertaking of the Neath Water Company (who were incorporated by an Act of 1861, and obtained their last Act in 1885) under conditions set out in a scheduled agreement. The capital of the Company is £29,720, with debenture stock amounting to £8964. The transfer is to take effect on payment by the Corporation of £30,070, and the price of the loose stock, and of a further sum of £7000 if the Skewen portion of the undertaking is eventually included in the sale. The money to be borrowed includes the amounts named, and also the sum of £25,000 for the construction of new works. An agreement relating to certain leasehold land is confirmed. A new reservoir is to be made by an impounding embankment thrown across the Moss House Dingle, in the parish of Llantwit-juxta-Neath. The reservoir authorized by the Act of 1885 is to be abandoned. A deposit fund of £790 in the hands of the Paymaster-General under the terms of the Act of 1885 is to be paid out to the Corporation. Notwithstanding anything in the Company's Acts, it is desired to surcharge consumers outside the borough 15 per cent. upon the home rates. Surplus revenues are to be applied in reducing the price of water; and any deficiency is to be made good by a special rate, which is not to apply to the leasehold estate already referred to. The Local Authorities interested in the Skewen and Briton Ferry portions of the undertaking are to be empowered to purchase them. The Swindon Water Bill is to enable the Local Boards of Old Swindon and Swindon New Town, both in Wiltshire, to acquire the undertaking of the Swindon Water-Works Company, Limited, according to the terms of a scheduled agreement, dated April 7, 1893. The members of the two Local Boards for the time being are to be incorporated by the name of the Swindon Water Board, with power to delegate their duties to an Executive Committee of twelve. The Board contemplate the creation and issue to the Company, as the consideration payable under the agreement, of Swindon water stock to the amount of £112,500, the contributions to which are to be made by the Local Boards in the proportions of the rateable values for the time being of their respective districts. Surplus revenue is to be apportioned between the two Local Boards towards the relief of their district rates. New water-works are to be constructed, comprising a storeage reservoir in the parish of Wroughton, upon a stream forming the north-western boundary of Clouts Wood, to be completed within ten years. Rates for domestic supplies range from 5 per cent. upon rateable values exceeding £60 upwards.

The Aberdare Local Board Water-Works Bill is to enable the Local Board to extend their limits of supply, and to enlarge their works by the construction of an impounding reservoir on the stream known as Nant Melyn, and a pipe commencing in the Nant Moel Isaf stream and the necessary subsidiary works. Clauses are inserted in the Bill for the protection of the Aberdare and Glamorganshire Canal Companies, who have a prior right to the same waters. The sum of £28,000 is to be borrowed for the purposes of the Bill. The Bury Corporation Bill relates chiefly to sewerage works; but contains provision for enabling the Corporation to compulsorily acquire a piece of land in the township of Higher Booths, in the parish of Whalley, Lancashire, for the purposes of their water undertaking. The period for extending the Corporation water supply to the Haslingden district is to be prolonged by three years. The Cardiff Corporation Bill contains provisions to enable the Corporation to construct and maintain additional water-works. The undertaking was acquired in 1879, when the Corporation raised £470,000 for the purpose of purchasing and enlarging the property. An additional sum of £360,000 was authorized to be raised in 1884, when the Corporation were also empowered to take water from the River Taff Fawr. Up to Nov. 1, 1893, the Corporation have expended upon their water-works undertaking the sum of £962,904; and they are proceeding with the construction of the embankment of the Reservoir No. 1 authorized by the Act of 1884. They desire to raise an additional sum of £350,000 for water-works purposes, and to enlarge the reservoir already mentioned as in course of construction. A railway is to be made in connection with this work, commencing in the parish of Cantreff, and ending in the parish of Llanspythid. Clauses are inserted for facilitating the establishment of a thrift fund for Corporation employees. The Dundee Corporation Bill provides for the creation of the City and Royal Burgh of Dundee as a county of a city; and with a view to facilitating public business it proposes to abolish the separate meetings of the Dundee Water Commissioners, and to enable their business to be transacted at meetings of the Town Council and of its Committees. Power is also sought to issue redeemable water debenture stock for the mortgage loans raised by the Water Commissioners.

The Fulwood Local Board Bill is to empower the Local Board to improve their existing water supply by the construction of a reservoir, to be known as the Barnsfold No. 2 Reservoir, to be situated in the township of Goosnargh-with-Newsham, in Lancashire, and to be completed within seven years. Power is sought for the supply of water for hydraulic purposes, and for charging by meter, by agreement between the Local Board and any consumer. The sum of £10,000 is to be borrowed for water-works purposes. The Gloucester Corporation Bill contains provisions enabling the Corporation to enlarge their water-works by the construction of a well and pumping station in the parish of Oxenhall, and of a reservoir in Madams Wood in the parish of Newent, to be completed within ten years. Power is sought to supply for domestic and other purposes by measure. The sum of £45,000 is to be borrowed for the purposes of the Bill. The Millom Local Board Bill is to enable the Local Board to make a dam or weir on the stream known as the Stoupdale Beck, situated in the parish of Whicham, Cumberland, and to enlarge their Baystone Bank Reservoir by raising the embankment 3 feet—all to be completed within two years. The limits of supply are to be extended. The Swinton Local Board Bill is to enable the Local Board of Swinton in Yorkshire to improve their existing water supply by the addition of a new well and pumping-station in the township of Swinton, together with two covered storeage reservoirs. Power is sought to supply water within an area of one mile beyond the limits of the Local Board's district, and to charge by meter by agreement. The rate for domestic supply is to be 7 per cent. on rateable value. The Local Board propose to obtain certain mineral rights. The sum of £10,000 is to be borrowed for water-works purposes. The Torquay Water and Improvement Bill is to authorize the construction by the Corporation of certain road diversions and other works, with the object of preserving the water in their Hennock reservoirs from being contaminated. For these purposes, and for land, the sum of £43,000 is to be borrowed.

Lighting Railway Carriages with Gas on Pintsch's System in India.—We learn from the Administration Report on the Railways of India for 1892-3, by Lieut.-Col. R. A. Sargeaunt, R.E., that the Government have sanctioned an estimate for lighting 180 coaching vehicles on the East Indian Railway by gas on Pintsch's system in the chord and loop line mail trains and the joint stock for service to Bombay. The building for the gas-producing plant at Howrah is well advanced, and that at Allahabad commenced. The fittings for the carriages have not yet arrived. On the Oude and Rohilkund (State) Railway, the Government have approved of 571 coaching vehicles being lighted by gas on this plan. In April, 1892, Pintsch's system was introduced as an experiment on the Bombay, Baroda, and Central India Railway; the expenses being borne by the proprietors of the patent. One local train and one bogie carriage of the mail train were supplied with the reservoirs and necessary fittings; the gas-works being erected at Parel. On the Madras Railway, one of the Company's saloons having been experimentally lighted with Pintsch gas for a period of six months, with highly satisfactory results, an indent has gone forward for sanction for a complete set of gas-making apparatus and carriage lamps and reservoir fittings sufficient for introducing this system of gas lighting into the majority of the Company's passenger stock. An indent has also been sent forward for the necessary apparatus for manufacturing and supplying Pintsch gas on the South Indian Railway. At first 100 bogie coaching vehicles will be fitted up, and the remaining stock later on. Since the report above referred to was prepared, the Great Indian Peninsula Railway Company have given Pintsch's Patent Lighting Company, Limited, the official order for the erection of two oil-gas works in India, and the sending out of 997 sets of carriage fittings in addition to 22 sets delivered.

Rustless Coating for Iron.—In a recent number of the *Journal of the Society of Arts* there was a translation, by Mr. F. W. North, of a paper read before the Paris Société d'Encouragement, by M. Octave de Rochefort-Lucay, on the Bertrand processes for coating with magnetic oxide and enamelling iron and iron carburets, and also on a new process of tinning for cast iron. It is claimed for these processes that they are more simple than those of Messrs. Bower and Barff, and are based on a new discovery in chemistry. They may be stated as follows: If a thin adherent film of another metal is formed on the wrought or cast iron, and this iron, heated to 1000°, is exposed to a current of oxidizing gas, the oxygen penetrates through the film, oxidizes the iron, and magnetic oxide is the result. The formation of magnetic oxide, thus obtained, continues indefinitely; and the thickness of the coating of oxide increases according to the period of exposure to the oxidizing current, providing the temperature remains at about 1000°. As to the film of metal deposited in the first instance, it disappears in some obscure way; forming oxides which mingle with the magnetic oxide or volatilize according to the nature of the metal of which they are composed. M. Bertrand had then to find the most suitable metal, and the best method for depositing it on the article to be coated; and he has found that bronze gives every satisfaction from a practical point of view. For depositing the bronze on the iron, he employs electricity or wet baths, and uses sulphophenolic acid. The following is the method adopted for an oxidation: The article is cleansed (though the cleansing is not indispensable), then dipped for a few moments in a bath containing a solution of sulphophenate of copper and tin. The coating of bronze being formed, the article is immediately washed with cold water, dried with sawdust, and put into a furnace. Oxide forms; and at the end of from 15 to 30 minutes the article is taken out, sufficiently oxidized.

NOTES.

Professor Dewar on Liquid Air.

Much interest has been excited by Professor Dewar's work on liquid air at the Royal Institution; and it redounds greatly to the credit of the Professor that he has succeeded, within a very brief period of time, in reducing what was at first a mere scientific marvel to a condition which permits of its being treated as an aid to physical research. Professor Dewar's process is briefly as follows: Into the outer chamber of a double compressor he introduces, through a pipe, liquid nitrous oxide gas, under a pressure of about 1400 lbs. to the square inch. This is allowed to evaporate rapidly; thus producing a temperature round the inner chamber of −90° C. Into this cooled chamber is then introduced liquid ethylene, which is a gas at ordinary temperatures, under a pressure of 1800 lbs. to the square inch. When the inner chamber is full of ethylene, its rapid evaporation under exhaustion reduces the temperature to −145° C. Running through this inner chamber is a tube containing oxygen gas under a pressure of 750 lbs. to the square inch, which liquefies at the temperature already stated. By evaporating the liquid oxygen, a reduction of temperature is obtained whereby air under pressure solidifies at −207° C., and at −210° C. nitrogen also becomes a white crystalline substance. It should be observed that Dr. Oliver Lodge states as the point of corrected absolute zero a temperature represented by −294° C., at which, as he remarks, all actual matter would be frozen solid, and the molecules of a perfect gas even, although still quite detached and independent, would be lying all about the floor in an inert and stationary condition, and could be swept up. By jacketing the liquid air in liquid oxygen under vacuum, Professor Dewar has screened it from extraneous heat. Liquid air has been used for testing the strength of metals at 180° C. below zero, when it is found that the breaking strain is in all cases greatly increased, and with iron is nearly doubled. Thus it appears that, while at very low temperatures chemical forces are in abeyance, the physical force which we call cohesion is immensely increased. Low temperature affects the colour of many bodies; the brilliant scarlet of vermilion and mercuric iodide being reduced, under the influence of intense cold, to a pale orange—the original colour returning with the rise of temperature. Blues, on the other hand, are unaffected by cold; and the effect is comparatively small upon organic colouring matters of all tints.

The Safe Working of Steel.

In a paper read by Mr. Joseph Nodder before the North-East Coast Institution of Engineers and Shipbuilders, on the "Working of Mild Steel," it was remarked that the more general use of Siemens-Martin steel for boiler purposes is limited by fifteen years. In its early days, it was looked upon with considerable misgivings, which yet exist in the minds of not a few boiler makers and engineers; and there is evidence to show that instances of the failure of Siemens-Martin steel are better known than the causes of such failures—the steel and the steelmaker frequently receiving the blame that should rest upon other people. Mr. Nodder states that the most reliable and satisfactory results from Siemens-Martin steel are obtained from material of from 26 to 30 tons tensile strength, and not less than 20 per cent. elongation in 8 inches; any distinction between high and low tensiles within these limits being a fallacy. Mr. Nodder cites recent experiments carried out at Messrs. John Brown and Co.'s works in 1892 and 1893 as showing that the dangerous heat in steel working is at 400° Fahr.; also that Siemens-Martin or basic steel hammered at this temperature retains all the brittleness resulting from this dangerous heat, even when cold. Re-heating without working will, however, restore all the original ductility. It follows that annealing is a necessary finishing process for Siemens-Martin steel that has been heated and worked in any way, if failures are to be avoided. Steel does not suffer from being hammered or bent cold. Air cooling after annealing, even under extreme variations of temperature, can make no appreciable difference to steel of good structural quality; but water cooling renders it unfit for service without again re-heating. This communication appears to be the latest information on this important subject.

The Duty of Pumping-Engines.

The highest example of efficiency obtained in pumping water in the United States has been described by Professor R. H. Thurston before the New York Society of Mechanical Engineers. The machine in question is a triple-expansion vertical engine of the marine type, built for the Milwaukee Water-Works by the E. P. Allis Company from designs by Mr. Irving Reynolds, and guaranteed by the makers to give a duty of not less than 125 million foot-pounds per 1000 lbs. of dry steam. The engine works three pump-barrels, with single-acting plungers set at equal angles to give a uniform discharge. The capacity of the engine is 18 million gallons in 24 hours, raised 160 feet, at a speed of 20 revolutions per minute. The three cylinders are respectively of 28, 48, and 74 inches diameter, with a 60-inch stroke. The cylinders are jacketed with live steam; and the valve-gear is of the Corliss type, with the addition of poppet exhaust-valves from the low-pressure cylinder. The performance of this plant has been tested by students of the Cornell University, with the general result that the consumption of steam was found to be 12 lbs. per horse power per hour. This is evidently the high-water mark of contemporary American pumping-engine practice.

Safety-Lamp for Testing Proportions of Gas in Air.

A handy form of the hydrogen-oil safety-lamp, introduced by Dr. Clowes for testing the presence of inflammable gas in air, and made by Messrs. W. J. Fraser and Co., of London, has already been referred to in the JOURNAL. It is a modification of the Ashworth-Hepplewhite-Gray safety-lamp, with a hydrogen cylinder attached to form a handle, and a graduated scale fitted beside the burner for reading off the height of the "flame cap," which gives the measure of the proportions of inflammable gas in the atmosphere. The hydrogen cylinder is attachable to the lamp instantly, and is secured by a quarter-turn. When charged with hydrogen gas from a store cylinder, under about 100 lbs. pressure, it furnishes the standard testing-flame, burning continuously, for forty minutes. The manipulation of the lamp for making a test, passing from the ordinary luminous flame to the hydrogen flame, taking an observation, and back again, occupies about half a minute. The lamp will probably be used as follows: If the percentage of gas in the atmosphere is unknown, the oil-flame will first be reduced, and a cap looked for over it. If there is 3 per cent. of gas and upwards present, it will be detected in this way. If no cap is seen over the luminous flame, so that low percentages of gas have to be looked for, the standard hydrogen flame is exchanged for the luminous flame in the lamp, and the proportion of gas will be shown in this way if it is anything between 0·2 and 3 per cent. It is reported that this hydrogen-oil lamp satisfies the primary conditions of an efficient apparatus for exhibiting the presence of gas in air; being most convenient, safe, a good illuminant, and combining delicacy with accuracy over a wide range of indications.

Presentation to Mr. J. Orwell Phillips.—The officers of The Gaslight and Coke Company, at a meeting last Thursday, gave tangible expression to their appreciation of the late Secretary and General Manager—Mr. John Orwell Phillips—by presenting him with his portrait, painted by Mr. H. T. Wells, R.A.

Professor Lewes's University Extension Lectures on the Technology of Coal Gas.—In the JOURNAL last week we indicated the points to be dealt with by Professor Vivian B. Lewes, F.I.C., F.C.S., in the first two lectures of his course on the subject of "The Technology of Coal Gas," now being delivered at the Stratford Town Hall. The first lecture is reported elsewhere in the present issue, and the others will appear in succession. To-night the subject will be the composition of coal gas; and next Tuesday the destructive distillation of coal will be dealt with. On that occasion, the changes which take place in the constituents of coal under the influence of heat will be explained, and the solid and liquid residual products described. The effect of heat upon the gaseous products will likewise be considered; and the lecturer will conclude by showing how the temperatnre in the retort affects the volume and illuminating power of the gas and the tar resulting from the distillation of the coal.

The Gases Occluded in Coal.—We learn from *Nature* that an interesting investigation of the amount and nature of the gases occluded in the coal derived from several collieries in the Durham coal-field has been carried out by Mr. W. M'Connell, of the Durham College of Science. The collieries from which samples were taken are situate at different points along the same seam, known in Durham as the Hutton seam. It is bituminous coal, used as gas and as steam coal. The coal or coal dust was placed in an apparatus constructed entirely of glass, which was capable of continuous exhaustion while heated in baths to known temperatures varying from 100° to 180°. The gas previously occluded by the coal was delivered by the pump into a receiving gasholder, and subsequently measured and analyzed. The coals from the Ryhope Colliery were found to contain as combustible gases considerable quantities of occluded free hydrogen, marsh gas, ethane, and other members of the paraffin series of hydrocarbons as far as pentane. Moreover, a portion of the gas—consisting chiefly of the higher members of the paraffins and smaller quantities of olefines—is so firmly retained that crushing to fine powder, and heating to 180° under reduced pressure, is insufficient to remove it. It is also singular that the coal retains a remarkably high proportion of free oxygen in the occluded form, even after heating to 180°. In the case of the Hebburn Colliery—a notably "gassy" mine, in which frequent "blowers" are met with—the results are especially interesting. The "blowers" deliver such large quantities of gas, that some of it is actually "piped" up to the bank and burnt under the boilers. The combustible constituent of the gas thus utilized is found to be entirely marsh gas. The coal itself contains a relatively large volume of occluded gas—the combustible constituents being mainly marsh gas and ethane; and the ground coal and coal dust yield, in addition, considerable quantities of higher members of the paraffin series. From the whole of the results derived from the various collieries, there can be no doubt that the coal dust largely owes its sensitiveness to ignition to the denser occluded gaseous hydrocarbons which it retains so tenaciously.

TECHNICAL RECORD.

THE CHEMICAL TECHNOLOGY OF COAL GAS.

By Professor VIVIAN B. LEWES, F.I.C., F.C.S.

[A Course of Lectures delivered at the Stratford Town Hall.]

I.—*The Origin, Composition, and Storeage of Coal.*

Long before man inhabited the earth, and when the atmosphere was probably far more highly charged with carbon dioxide and water vapour than it is at present, there flourished a monster vegetation, which, in its general characteristics, was not unlike a collection of the marsh plants that are now to be found in any swampy land; but, instead of growing to the height of a few inches, their exuberant growth would in some cases reach 40 to 50 feet. This vegetation, like the marsh plants of to-day, grew with enormous rapidity, and as rapidly faded away; and by precisely the same process from which we obtain the peat bogs existing at the present time, so beds of far greater thickness were formed from the vegetation of that period.

The growth of a plant after its earliest stages is as dependent upon the atmosphere as it is upon the soil; and when we plant a seed, the moment that green petals and leaves begin to appear in the sprouting plant, it commences to assimilate, to a great extent, its nourishment from the atmosphere. If we examine the leaf of a growing plant, we find in it small funnel-shaped openings, which botanists call "stomata." These terminate in little glands full of the green matter, which gives the colour to the plant. This colouring matter is termed "chlorophyll;" and it may be extracted by macerating green leaves or grass in alcohol, when a green solution is produced, which is composed of a mixture of a bluish and a yellowish-brown liquid. While the plant is actively growing during the spring or summer months, both these liquids co-exist, and so colour the leaves green; but with the early autumn frosts, the bluish chlorophyll decomposes, and the yellowish-brown compound, left by itself, gives the autumn tints.

This chlorophyll has the wonderful power of absorbing carbon dioxide, or carbonic acid gas, from the atmosphere, which contains it to the extent of at least 4 parts in 10,000; the quantity being continuously renewed by the processes of combustion, respiration, and decay, all of which remove oxygen from the atmosphere, and replace it by carbon dioxide. This carbon dioxide, together with water vapour, partly absorbed by the tissue of the plant, and partly drawn up from the soil in which the plant is growing, is decomposed, and a compound is formed called "cellulose," or woody fibre, having the following percentage composition:—

Carbon	44·44
Hydrogen	6·17
Oxygen	49·39
	100·00

while the oxygen which was originally present in the carbon dioxide is put back into the atmosphere, and keeps it in a fit state for respiration. The woody fibre which forms the main structure of the plant may, therefore, be looked upon as being entirely derived from the water and carbon obtained from the carbon dioxide; and the synthetical processes which commence with the absorption of carbon dioxide and terminate with the production of cellulose are carried on under the influence of the sun's rays.

When a tree or other form of vegetation has ceased growing, and is left exposed to moist air, the reverse process commences, and the wood begins to decay in contact with the air, the oxygen of which once again unites with the carbon of the woody fibre, forming carbon dioxide, which mingles with the atmosphere, while the hydrogen and oxygen of the fibre, once more re-combining, escape unseen into the atmosphere in the form of aqueous vapour. Consequently, a tree which has been felled and left on the ground will, in the course of years, be entirely resolved into gaseous constituents once more; leaving behind only a small quantity of mineral matter which had been present in the sap sucked up from the soil, and which, had the wood been burned, would have formed the ash left behind by the combustion. If, instead of allowing the wood to decay away in free contact with the atmosphere, this action had been checked by keeping the wood under the surface of water or a sufficient layer of soil to cut off the atmospheric oxygen, a checked process of decay would have taken place, in which the oxygen present in the woody fibre would gradually have combined with carbon and hydrogen to form gaseous constituents, while some of the carbon and hydrogen, also combining together, would have yielded small quantities of such gaseous hydrocarbons as methane. We know by experience that if a pool of water, at the bottom of which there is decomposing vegetable matter, be disturbed with a pole, bubbles of gas rise to the surface; and if we collect and analyze them, we find that they consist of carbon dioxide and methane, which latter has from this fact been given the name of "marsh gas." Where the vegetation undergoing the checked process of decay of this kind is very abundant, a solid residue is left, to which we have given the name of "peat;" while if the action is continued over a far longer period of time, and also under conditions of pressure and increased temperature, the peat becomes more dense, a larger quantity of gas is eliminated, and a form of coal results.

At one time it was supposed that coal was of mineral origin; but it has now been conclusively established that it is entirely formed from vegetable matter. Ample proof of this origin is to be found in the strata immediately above the coal seam, which abounds in fossil remains and upwards of 500 different kinds of mosses and ferns; while in the layer immediately below the seam, fossil roots are found in abundance. The three principal varieties of coal are lignite, bituminous coal, and anthracite. The lignite, or brown coal, is the least carbonized, and shows indications of organized structure, and also contains considerable proportions of hydrogen and oxygen; while anthracite is the most carbonized, and often contains little else than carbon and the mineral matter which forms the ash.

When moist vegetable matter undergoes fermentation and decay, carbon dioxide and marsh gas are the gaseous compounds which escape; and it is easily conceivable that the final action taking place during long ages, aided by pressure and the internal heat of the earth, is the conversion of woody fibre into carbon, in the dense form known to us as graphite, while intermediate steps in the decomposition give us peat, lignite, bituminous coal, and anthracite. The complete reaction could be represented by the following equation:—

Woody Fibre. Carbon Dioxide. Marsh Gas. Carbon.

$$2\,(C_6H_{10}O_5) = 5CO_2 + 5CH_4 + C_2$$

which is supported by the fact that these two gases are always found in the coal seams. The theory that bituminous coal is a "younger" coal than anthracite is not, however, borne out by the fact that, in the eastern part of Wales, the coal is of a bituminous nature, gradually shading away into the anthracite, found in the western portion of the Principality, as it is extremely unlikely that there is any very great difference in the age of the several parts of the Welsh coal-field.

The gradual conversion of woody fibre into peat, coal, and graphite is illustrated by the following table, in which, to show the gradual elimination of hydrogen and oxygen, the carbon is kept as a constant number:—

	Carbon.	Hydrogen.	Oxygen.
Wood	100	12·18	88·07
Peat	100	9·85	55·67
Lignite	100	8·37	42·42
Bituminous coal	100	6·12	21·23
Anthracite (Wales)	100	4·75	5·28
,, (Pennsylvania)	100	2·84	1·74
Graphite	100	0·00	0·00

The quantity of hydrogen present in a fuel exercises an important influence upon the way in which it burns, as hydrogen is expelled at a fairly low temperature in combination with some of the carbon as gases which are inflammable at a moderate temperature. The burning gas surrounds the fuel and continues to heat it, while the escape of the gas leaves the remaining and less inflammable carbon in a porous condition, which is favourable to carrying on the combustion. Flame is burning gas; and therefore the nearer to pure carbon that our fuel approaches, the less the amount of flame produced by its combustion, because the smaller will be the quantity of inflammable gas evolved. Lignite contains a larger amount of hydrogen than any other variety of coal; and it is for this reason more easily ignited, and burns with more flame than any of the others. The next in this respect are the bituminous coals, such as the Silkstone and Wallsend; while the anthracites are difficult to ignite, and when lit can only be kept burning by a strong draught—this rendering them unfit for use in ordinary grates.

Our knowledge of the composition of coal is limited to the total amount of carbon, hydrogen, nitrogen, oxygen, and foreign materials which it contains; and at present we know practically nothing of the way in which these bodies are combined. There can be but little doubt, however, that it is correct to look upon it as carbon which contains, either mixed with it or combined with it, hydrocarbon compounds of much the same character as the paraffins, and also compounds of carbon, hydrogen, and oxygen of somewhat similar kind to the woody fibre from which it has sprung, while other compounds containing nitrogen, and probably of more complexity, are also present.

The following table will give an idea of the proportions in which the ultimate constituents exist in some of the gas coals:—

	Carbon.	Hydrogen.	Nitrogen.	Oxygen.	Sulphur.	Ash.	Moisture.
South Yorkshire Silkstones.							
Barrow	80·33	5·04	1·94	7·26	1·24	3·24	0·95
Hoyland	80·46	5·09	1·67	6·79	1·66	3·30	1·03
Thorncliffe	81·98	5·70	1·83	5·26	1·52	2·36	1·35
Derbyshire Silkstones.							
Albert	76·84	5·22	1·59	5·60	2·34	4·45	3·96
Plumbley	76·96	5·04	1·77	6·92	2·39	3·28	3·64
Barnsley Gas Coals.							
Darfield	76·63	4·79	1·76	7·56	1·28	3·93	0·82
Monckton	75·64	4·94	1·65	7·25	2·84	4·28	3·40
Treeton	75·61	5·08	1·59	6·90	2·61	4·65	3·56

As has already been pointed out, methane and carbon dioxide are produced during the process of checked decomposition which leads to the formation of the coal. In the early days of the coal epoch, when the monster vegetation was flourishing, and the surface of the earth had hardly yet hardened, frequent changes of level took place, with the result that many of these beds of decomposing vegetable matter became covered with running water, which, bringing down with it silt and deposits, gradually built up over its surface a dense mass of

soil; and this hardening and undergoing various changes, enclosed the gradually forming coal, and kept it under great pressure. Under these conditions, the marsh gas, or methane, and carbon dioxide evolved could not escape, and they created for themselves, in the faults and fissures in the coal, an enormously high pressure, while the coal itself, being slightly porous, absorbed these gases in large quantities; so that when, in mining the coal, a gallery is cut through the seam, the occluded gas escapes in considerable quantities into the workings of the mine. In some cases, the gas so evolved proves to be nearly pure methane, as is shown by the following analysis:—

Methane	89·61
Nitrogen	9·61
Carbon dioxide	0·23
Oxygen	0·55
	100·00

Marsh gas, when combined with ten times its volume of air, or twice its volume of oxygen, constitutes a mixture which explodes with great violence on the application of light, forming carbon dioxide and water vapour, as shown by the following equation:—

Marsh Gas.		Oxygen.		Carbon Dioxide.		Water.
CH_4	+	$2O_2$	=	CO_2	+	$2(H_2O)$.

In coal mines, not only is marsh gas present occluded in the coal itself, and ready to issue into the workings when a fall in the barometer takes place, but is also often found accumulated under high pressure in cavities in the coal seams—discharging itself with considerable violence into the mines from the fissures made in hewing out the coal. The gas issuing from the fissure would burn quietly if a light were applied to it, since marsh gas is not explosive unless mixed with air; but when the gas escapes into the working and mingles with air, it forms an explosive compound as soon as the proportion of gas amounts to 1-18th of the volume of the air—the most explosive combination consisting of one volume of marsh gas and ten volumes of air. The explosive mixture of marsh gas and air is called "fire-damp;" and the gases resulting from the explosion—carbon dioxide, water vapour, and nitrogen—are called "choke-damp." The latter is often as fatal in its effect as the explosion itself.

The mixture of marsh gas and oxygen requires a fixed temperature to ignite it; and unless this temperature be reached, explosion cannot result. If a piece of wire gauze is held over a gas-jet, the gas may be lighted above it without the flame passing through and igniting the gas on the under side; the metallic wires composing the wire gauze conducting the heat away so rapidly that the temperature of the gas on the lower side does not rise to the point of ignition. This simple principle was utilized by Sir Humphry Davy in the construction of the safety-lamp for miners. It consists of an oil-lamp entirely surrounded with fine wire gauze, through which the air can enter and the products of combustion go out, but no flame pass from the inside to the outside of the gauze, even if the explosive gases burn in the interior of the lamp. The old form first used was entirely surrounded with wire gauze; but it gave so feeble an illumination that the gauze immediately surrounding the flame was replaced by a glass cylinder. Until 1887 this was the best form in use. It has been shown, however, that although the flame, when burning under ordinary conditions, cannot pass through the gauze, yet a sudden disturbance of the air, such as is caused by the blasting of coal in the mine, will sometimes jerk the flame by a sudden impluse through the gauze, and so communicate with the explosive mixture outside. To do away with this risk, a new form of lamp has been introduced, in which the wire-gauze cylinder is entirely surrounded by a shield of iron plate, which prevents the direct impact of the air upon the gauze, and greatly increases the value of the lamp. It would considerably decrease the risk of explosion in coal-stores, coal-bunkers, and coaling-vessels if, when a light is required, only such lamps were used, and the employment of a naked flame never allowed, as, besides the gas, it has been shown that the presence of fine dust of coal very much increases the liability to explosion.

The coals used for the production of illuminating gas are all of bituminous or caking character, of which class the Durham and Northumberland coals may be taken as good examples; while for enrichment, the cannel or "parrot" coal is largely employed. As before pointed out, our knowledge of the composition of the hydrocarbon compounds present in coal is so limited, that the ordinary analysis of a coal affords but little indication of its value for the production of illuminating gas; but there is one point which is highly suggestive, and which has received but a small amount of the attention it deserves. In a report made by M. Ste.-Claire Deville in 1886 upon a series of experiments, extending over twelve years, which were carried out at La Villette (Paris) with 59 different kinds of coal, he clearly establishes the fact that as the amount of oxygen in the original coal—oxygen in combination with hydrocarbons—increases, so does the total amount of volatile matter present in the coal rise in quantity, while the density and illuminating value of the gas produced also increase; and he comes to the conclusion that the best gas coals are those containing from 7·5 to 9 per cent. of oxygen. Less oxygen than this in the coal means that the coke will be plentiful, but the gas poor; while if the oxygen is above the standard, the coke is bad. This fact seems to point to the valuable hydrocarbons for gas production in the coal being oxygenated bodies, which, like fatty acids or alcohols, would decompose with formation of ethylene, methane, hydrogen, and oxides of carbon at the temperature of the gas-retort, and not, as has been more ordinarily supposed, bodies like paraffins.

The effect which the combined oxygen has upon the composition of the gas obtained from the coal is also instructive:—

Percentage of oxygen in coal	5 to 6·5	6·5 to 7·5	7·5 to 9	9 to 11	11 to 12
Composition of gas—					
Carbon dioxide	1·47	1·58	1·72	2·79	3·13
Carbon monoxide	6·68	7·19	8·21	9·86	11·93
Hydrogen	54·21	52·79	50·10	45·45	42·26
Benzols	0·79	0·99	0·66	1·04	0·88
Methane	34·37	34·43	35·03	36·42	37·14
Ethylene	2·48	3·02	3·98	4·44	4·76
Density of gas	0·352	0·376	0·399	0·441	0·482

It will be seen from the preceding table that the proportion of oxides of carbon increases with the rise in the oxygen, as also does the ethylene, while the hydrogen decreases.

The actions which take place when coal is stored is another subject which deserves the gravest attention from the gas manager, as the long keeping of coal in stock undoubtedly has a very considerable effect upon its value for gas making; and, under certain conditions, the chemical actions which take place lead to heating, and even to spontaneous ignition of the coal in the stores.

We have seen that coal may be looked upon as being composed of carbon and various hydrocarbons. Beside these, it also contains certain mineral bodies, which were mostly present in the sap and fibre of the original vegetation, and produce the ash left behind when the coal is burned. These substances consist chiefly of sulphate of lime, or gypsum, silica, and alumina; while in nearly all kinds of coal is to be found a substance called disulphide of iron—coal "brasses," or pyrites—which has been formed by the gradual reduction of the sulphates by carbonaceous matter in the presence of iron salts, and which during the combustion of the coal is decomposed, giving off sulphur compounds, and leaving behind oxide of iron, which imparts the reddish-brown colour to the ash of many kinds of coal. Of these constituents of coal, the only ones which do not play any part in the phenomena attending weathering and heating are the mineral constituents other than the pyrites; and therefore we have to deal with the chemical actions which take place when the carbon, hydrocarbons, and "brasses" contained in newly-won coal come in contact with air and moisture.

(A) *The Influence of Carbon in Weathering and Heating.*—Carbon is one of those substances which possess to an extraordinary degree the power of attracting and condensing gases upon their surface; this power varying with the state of division of the particular character of carbon used. The charcoal obtained from dense forms of wood, such as box, exhibits this property to a high degree; one cubic inch of such charcoal absorbing, according to Saussure—

Ammonia gas	90·00 cubic inches.
Sulphuretted hydrogen	55·00 "
Carbon dioxide	35·00 "
Ethylene (olefiant gas)	35·00 "
Oxygen	9·25 "
Nitrogen	6·50 "

while certain kinds of coal also exhibit the same power, although to a less degree. The absorptive power of newly-won coal, due to this surface attraction, varies; but the least absorbent will take up one-and-a-quarter times its own volume of oxygen, while in some coals more than three times their volume of the gas is absorbed. This absorption is very rapid at first, but gradually decreases, and is moreover influenced very much by temperature, for reasons which will be explained later. The absorption is at first purely mechanical, and itself causes a rise of temperature, which in the case of charcoal formed in closed retorts—as in preparing alder, willow, and dogwood charcoal for powder making—would produce spontaneous ignition if it were not placed in sealed cooling-vessels for some days before exposure to air. The rate of absorption varies with the amount of surface exposed, and therefore able to take part in this condensing action; so that when a coal or a charcoal is finely powdered, the exposed surface being much greater, absorption becomes more rapid, and rise of temperature at once takes place. If, after it has been made, charcoal is kept for a day out of contact with air, and is then ground down into a powder, it will frequently fire after exposure to the air for 36 hours; while a heap of charcoal powder of 100 bushels or more will always ignite. It is for this reason that, in making the charcoal for powder, it is always kept, after burning, for three or four days in air-tight cylinders before being picked over, and from ten days to a fortnight before it is ground. In the case of coal, this rise of temperature tends to increase the rate of the action that is going on, but is rarely sufficient to bring about spontaneous ignition, as only about one-third the amount of oxygen being absorbed is taken up by charcoal; and the action being much slower tends to prevent the temperature reaching the high ignition-point of the coal. Air-dried coal absorbs oxygen more quickly than wet coal.

(B) *The Action of the Bituminous Constituents of the Coal in Weathering and Heating.*—All coal contains a certain percentage of hydrogen, which is in combination with some of the carbon,

and also with the nitrogen and oxygen, and forms with them the volatile matter in the coal; and the amount present in this condition varies greatly—being very small in anthracite, and large in cannel and shale. When the carbon of the coal absorbs oxygen, the compressed gas becomes chemically very active, and soon commences to combine with the carbon and hydrogen of the bituminous portions, converting them into carbon dioxide and water vapour. This chemical activity increases rapidly with rise of temperature; so that the heat generated by the absorption of the oxygen causes it to rapidly enter into chemical combination. Chemical combination of this kind—*i.e.*, oxidation—is always accompanied by evolution of heat; and this further rise of temperature again increases the rapidity of oxidation, so that a steady rise of temperature is set up. This taking place in the centre of a heap of small coal, which, from the air and other gases enclosed in its interstices, is an admirable non-conductor of heat, will often cause such heating of the mass that, if air percolate slowly into the heap in sufficient quantity to supply the necessary percentage of oxygen for the continuance of the action, the igniting-point of the coal will eventually be reached.

The effect of rise of temperature in increasing the rapidity of chemical action of this kind can be realized from the influence it has on the spontaneous ignition of oily waste or rag. If a substance like cotton waste be rendered oily with anything except the mineral oils, it acquires the power of taking up oxygen from the air; and this oxidizing the oil gives rise to heat. At ordinary temperatures, the process is slow; and consequently it may be days before the increase in temperature becomes sensible. When, however, this point is reached, the oxidation proceeds with remarkable rapidity, and in a few hours the point of ignition is attained, and the mass bursts into flame; while if the oily waste be put in a warm place at first, spontaneous ignition is only a question of hours, and sometimes even of minutes. Galletly found that oily cotton at ordinary temperatures took some days to heat and ignite; while if deposited in a chamber warmed to from 130° to 170° Fahr. (54° to 76° C.), cotton greasy with boiled linseed ignited in 1 hour 15 min., and olive oil on cotton in five hours. In a chamber heated to a temperature of 180° to 200° Fahr. (82° to 93° C.), olive oil on cotton ignited in two hours.

It has been suggested that very bituminous coal, such as cannel, shale, and coal containing schist, is liable to spontaneous ignition from the fact that a rise in temperature would cause to exude from it heavy oils, which, by undergoing oxidation, might cause rapid heating. But experiment not only shows that this is not the case, but that the heavy mineral oils have a remarkable effect in retarding heating; cotton waste oily with easily oxidizable oils mixed with 20 per cent. of heavy mineral oil being exempt from heating.

(C) *The Action of Iron Disulphide, Pyrites, or Coal "Brasses," in Promoting Heating.*—The earliest theory as to the cause of spontaneous ignition in coal was that it was due to the heat given out during the oxidation of pyrites—the disulphide of iron—into sulphates. This idea has been adopted, and has held its own in this country up to the present time, although the researches of Dr. Richters, some twenty years ago, clearly prove that the explanation was an erroneous one, and the late Dr. Percy, as early as 1864, pointed out that probably oxidation of the coal had a great deal to do with the action. This disulphide of iron is found in coal in several different forms—occasionally as a dark powder, distributed throughout the mass of the coal, and scarcely to be distinguished from the coal itself. In larger quantities it is often met with in the form of thin golden-looking layers in the cleavage of the coal; while sometimes it occurs as masses and veins, often one or two inches in thickness. But inasmuch as these masses of pyrites are very heavy, they rarely find their way into the screened coal for shipment; many hundred tons of these "brasses" being annually picked out from the coal at the pit's mouth, and utilized in various manufacturing processes. The yellow pyrites which constitute the large masses in the coal, and even the dark varieties when in the crystalline form, remain practically unaltered even after long exposure to moist air; but the amorphous and finely-divided portions, which probably contain lower sulphide mixed with the disulphide, will oxidize and effloresce with considerable rapidity when exposed to moisture and air—forming mixtures of ferrous sulphate and basic sulphates of iron. It is during this process of oxidation that the heat supposed to bring about the ignition of the coal is generated. In some of the coals most liable to spontaneous ignition, there is only 0·8 per cent. of pyrites. If we imagined the whole of this to be easily oxidizable, and to be concentrated in one spot, instead of being spread throughout the mass, and to be entirely oxidized in a few hours, the rise of temperature would only be a few degrees; whereas, under existing circumstances, it is manifest that practically no determinable increase can be generated by the action.

Under certain conditions, the oxidation of masses of pyrites first gives rise to the formation of ferrous sulphate and sulphur dioxide, with liberation of sulphur; and my early experiments led me to believe that, inasmuch as sulphur has an igniting-point of 250°C., this free sulphur might play an important part in the action by lowering the point of ignition. Later experiments, however, showed that this could only take place with large masses of pyrites undergoing oxidation, and that, with the amounts contained in coal, if the air were present in sufficient quantity to oxidize the pyrites, the small trace of sulphur liberated would be oxidized to sulphur dioxide at temperatures as low as 60° C. This oxidation of sulphur at low temperatures is not a generally known action; but experiments show that it takes place with considerable rapidity. The only way in which pyrites in the cleavage of coal can assist spontaneous ignition, is that when they oxidize they swell, and cause disintegration of the lumps of coal—so exposing fresh surfaces to absorb oxygen, and afterwards carry on chemical action.

I have carefully determined the igniting-points of various kinds of coal, and I find that cannel coal ignites at 698° Fahr. (370° C.); Hartlepool coal, at 766° Fahr. (408° C.); lignite coal, at 842° Fahr. (450° C.); and Welsh steam coal, at 870·5° Fahr. (477° C.). So that no stretch of imagination could endow the small trace of pyrites scattered through a large mass of coal, and undergoing slow oxidation, with the power of reaching the needful temperature. When coal is heating, it gives out a distinctive and penetrating odour, which is the same as that noticed when wood is scorched. The gases evolved by the heating coal consist of nitrogen, water vapour, carbon dioxide, carbon monoxide, hydrocarbons of the paraffin series, and sulphuretted hydrogen; the presence of the latter gas showing beyond doubt that oxidation of the sulphur has nothing whatever to do with the action.

We can now trace the actions which culminate in heating or ignition. The newly-won coal is brought to the mouth of the pit, and at once commences, by virtue of its surface action, to absorb oxygen from the air; but, unless it is piled in unusually large heaps, and a great deal broken, it does not, as a rule, show signs of heating, as the exposed surface is comparatively small, and the air, finding its way freely between the lumps, keeps down the temperature. The coal is now screened, and the largest lumps of pyrites picked out. It is then put into the trucks, where, owing to the innumerable shuntings and joltings, it gets broken up still further; thus increasing the amount of surface exposed to the air. On arriving at the docks, it is transferred to the ship down some form of tip, shoot, or spout; and it is at this period that the most harm is done. The coal first shot into the vessel is reduced, by reason of the distance it has to fall, to small lumps, and, having to bear the impact of each succeeding load, rapidly becomes powdered into slack. The succeeding coal gets more or less broken up also; so that, by the time the cargo is taken in, a dense mass of small coal is to be found under the hatchway. As the breaking up of the coal is further increased during the process of unloading, a large proportion of small coal finds its way into the stores, causing rapid absorption of the oxygen, and consequent rise in temperature. This sets up chemical combination between the oxygen taken in by the coal and the hydrocarbons, reduces the value of the coal for gas making, and leads to heating.

On examining the evidence to be obtained as to the conditions under which heating usually takes place, it is found that liability to it and to ignition increases with (1) the increase in the mass of coal. Thus, in masses of less than 500 tons, the cases reported amounted to under ¼ per cent.; from 500 to 1000 tons, to over 1 per cent.; from 1000 to 1500 tons, to 3·5 per cent.; from 1500 to 2000 tons, to 4·5 per cent.; and above 2000 tons, to over 9 per cent. This clearly shows the influence of mass upon the action, which operates in two ways: (*a*) The larger the mass, the more non-conducting material will there be between the spot at which heating is taking place and the cooling influence of the outer air; and (*b*) the greater will be the breaking-down action during shipment and storeage, and the larger, therefore, the fresh surface of coal that is exposed to the air.

(2) The kind of coal—some coals being specially liable to spontaneous heating and ignition. This is a point on which great diversity of opinion exists; but it is generally admitted that cases of ignition occur most frequently in coals from east coast ports. The idea that the percentage of pyrites present is any indication of the liability to spontaneous combustion must be entirely discarded, as experiment shows that many coals poor in pyrites frequently ignite, while others rich in them are perfectly safe. A much more reliable guide is to be found in the quantity of moisture present in an air-dried sample of coal, which is a sure index to the absorptive power. The higher the amount of moisture held by the coal, after exposure for some time in dry air, the greater will be its power of absorption for oxygen, and the greater, therefore, its liability to spontaneous ignition and heating. This is beautifully shown by the following table, in which the percentages of pyrites and moisture present in the same coals are contrasted with their liability to self-ignition.

Liability to Spontaneous Ignition.	Pyrites.	Moisture.
Very slight	1·13	2·54
	1·01—3·04	2·75
	1·51	3·90
Medium	1·20	4·50
	1·08	4·55
	1·15	4·75
	1·12	4·85
Great	0·83	5·30
	0·84	5·52
	1·00	9·01

The percentage of moisture shown in this table is not due to external wetting, but is moisture absorbed from the air and held by the coal; so that the amount of it present is an indication of

the capacity for absorption which is possessed by the coal, and which will give it the power of taking up oxygen as well as water vapour.

(3) The size of the coal—small coal being much more liable to spontaneous ignition than large. This, as has been pointed out, is entirely due to the increase in the active absorbing surface exposed to the air—a fact which is verified by the experience of large consumers. Gas managers recognize the fact that coal which has been stamped down or shaken down during storeage is more liable to heat than if it had been more tenderly handled—the extra breakage causing the additional risk.

(4) Shipping or storing coals while wet. The effect of moisture upon coal is very remarkable. At first external wetting retards the absorption of oxygen by the coal; but the presence of moisture afterwards increases the action of the already absorbed oxygen upon the hydrocarbons of the coal, and so causes a serious increase in the heating. Of late years, the researches of Cowper, Dixon, Baker, and others, have shown so fully the important part which moisture plays in chemical combination, that it is now fully recognized as a factor of importance in actions of this kind. A case in point came under my notice a year or two ago. A ship took in a cargo of coal at a Welsh port; the weather being fine and dry while she was loading at the main hatch, and wet when she was taking in the coal at the after-hatch. The result was that the temperature after the first few days was uniformly about 10° higher in the coal that had been loaded wet than in the dry portion of the cargo—spontaneous ignition being the ultimate result.

(5) Ventilation of the mass of coal. The so-called ventilation which has from time to time been introduced into coal-stores is undoubtedly one of the most prolific causes of heating. For ventilation to do any good, cool air would have to sweep continually and freely through every part of the coal—a condition impossible to attain. Anything short of this only increases the danger; the ordinary methods of ventilation supplying just about the right quantity of air to create the maximun amount of heating. The reason of this is clear. Coal absorbs about twice its own volume of oxygen, and takes about ten days to do it under favourable conditions; and it is this oxygen which, in the next phase of the action, enters into chemical combination, and causes the serious heating. A ton of coal occupies from 42 to 43 cubic feet; and, if properly loaded, contains between the lumps 12 cubic feet of space—that is to say, of the 42 cubic feet, 12 cubic feet are air and 30 cubic feet coal. This 30 cubic feet of coal, with its fresh absorbing surfaces laid bare by the crushing incidental to loading, will, in the first ten days, absorb 60 cubic feet of oxygen, if it can get it. Air contains only, roughly, one-fifth of its volume of oxygen; so that 60 cubic feet represent 300 cubic feet of air, or 25 times as much as is present. It is therefore evident that, if air could be excluded, there would be only 1-25th the quantity of oxygen present which is needed for complete action, and any heating would, in consequence, be very slight; while to produce the greatest heating, it would be necessary to change the entire air in the coal 25 times in the first ten days. This is just about what makeshift methods of ventilation will give. The most forcible illustration of the evil of such ventilation in shipping coal is to be found in the case of the four colliers *Euxine*, *Oliver Cromwell*, *Calcutta*, and *Corah*, which were loaded at Newcastle under the same tips, at the same time, and with the same coal from one seam. The first three were bound for Aden, and were all ventilated. The *Corah* was bound for Bombay, and was not ventilated. The three thoroughly ventilated ships were totally lost from spontaneous ignition of their cargo, while the *Corah* reached Bombay in perfect safety.

(6) Rise in temperature. It has been fully pointed out that anything which tends to rise of initial temperature increases the rapidity of chemical action; and in most cases of spontaneous combustion in coals stored in this country, the cause can be traced to a steam-pipe or boiler-flue in contact with the mass of coal, or even fixed to a wall against which, on the other side, the coal is heaped. Sometimes the coal-store is close to the retort-benches in a gas-works, or even against the wall of the benches; and in such cases ignition would be almost sure to take place with certain classes of coals. On colliers there are many causes of increased temperature; among them being the introduction of triple-expansion engines and high-pressure boilers. Then, again, donkey boilers will be found recessed into bunker bulkheads, with the cargo close up against them on the other side. The effect of temperature due to climatic influences is also important.

Having now discussed the chemical and physical conditions which lead to the phenomenon known as spontaneous ignition, we can formulate precautions which will tend to prevent such disasters.

The Choice of Coal for Storeage or Shipment.—The coal should be as large as possible, free from dust, and with as little "smalls" as can be helped. It is better for it to be as free from pyrites as possible; and it should contain, when air-dried, not more than 3 per cent. of moisture.

Precautions to be taken in Storing or Loading.—The coal-store should be well roofed in, and have an iron floor bedded in cement. All supports passing through, and in contact with, the coal should be of iron or brick; if hollow iron supports are used, they should be cast solid with cement. The coal must never be loaded or stored during wet weather; and the depth of coal in the store should not exceed 8 feet, and should be only 6 feet where possible. Under no condition must a steam or an exhaust pipe or flue be allowed in or near any wall of the store; nor must the store be within 20 feet of any boiler, furnace, or bench of retorts. Every care should be taken, during loading or storing, to prevent breaking or crushing of the coal; and on no account must a large accumulation of small coal be permitted. These precautions, supposing they are properly carried out, would amply suffice to entirely do away with spontaneous ignition, or even with serious heating in coal when stored on land.

It is manifest that, if coal heats, even if no ignition occurs, a serious oxidation and loss of the volatile hydrocarbons most valuable for gas-making purposes must take place, as the absorbed oxygen does not attach itself to the hydrocarbons, but actively oxidizes them, as can be clearly proved by the absorption of oxygen by newly-won coal being rapidly followed by the evolution of carbon dioxide. The weathering of coal has been studied by Fleck, Grundmann, Richters, and myself; and the general conclusions arrived at are that, when broken-up coal is exposed to the air, its weight increases at first, and at the same time carbon dioxide and water vapour are given off; but the increase due to oxygen absorbed more than counterbalances the loss. After this stage has been passed, there is a slight loss of weight, and then it becomes constant. This probably means that the amount of readily oxidizable matter in the coal is limited, and that, as soon as this has been destroyed, there is no further oxidation by the absorbed oxygen. The amount of moisture which a coal contains has an enormous influence upon the rapidity of the oxidation of the hydrocarbons by the absorbed oxygen, as, although a wet coal absorbs the gas less quickly, the presence of water afterwards aids the oxidation going on. From these considerations, it is manifestly wrong to have large stores of coal which are both fed and drawn from the top, as this means that the portions at the bottom may remain there for years, and when at last they are used for the purposes of gas making, they will be found to yield gas of an extremely poor illuminating value.

It has already been pointed out that coals liable to spontaneous heating and ignition are characterized, not by a high percentage of pyrites, but by holding a large amount of water when air-dried; and this, taken in conjunction with the increase of weight which results when the coal is heated to about 250° Fahr. in an oven for three hours, affords a very fair test of the safety of a coal for shipment or storeage. The relation which exists between the quantity of water present in an air-dried coal and its power of absorbing oxygen is well shown in the following experiment made by Richters: The coals used were newly raised and coarsely powdered, but free from dust. They were air-dried, and the readings give the amount of oxygen absorbed by 20 grammes of each during 24 hours; the experiment extending over twelve days:—

Per cent. Moisture	2·54	3·10	5·15	5·2	5·25
Days.	c.c.	c.c.	c.c.	c.c.	c.c.
1	3·0	5·0	9·0	9·1	7·3
2	2·8	4·7	8·2	9·0	7·0
3	1·5	4·0	5·0	5·6	6·3
4	1·5	3·8	3·4	4·0	5·0
5	1·5	3·8	3·0	3·6	4·6
6	1·4	3·5	3·4	3·0	3·9
7	1·2	3·1	2·4	3·0	3·8
8	1·2	2·9	2·7	2·8	2·8
9	1·0	2·6	2·7	2·6	2·9
10	1·2	2·5	2·0	2·6	2·4
11	1·0	2·0	2·0	2·5	2·0
12	0·9	2·0	2·0	2·3	2·0
	18·2	39·9	45·8	50·1	50·0

As 20 grammes of coal free from air occupy about 15 c.c., it is manifest that the least absorbent has taken up more than its own bulk of oxygen, while the most absorbent has taken up more than three times its own volume.

It is very difficult to obtain authentic information as to the amount of absorption which conduces to dangerous oxidation; but my own experience leads me to think that, if an air-dried coal does not contain more than 3 per cent. of moisture, and, when powdered and heated at 250° Fahr. in an oven for three hours, does not increase more than about 2 per cent. in weight, it may be looked upon as a safe coal to store in bulk as long as it is kept dry.

The Late Professor Hertz.—Professor Heinrich Hertz, the distinguished physicist of Bonn, whose death has recently been announced, was born at Hamburg in 1857; and he studied physics in Munich, and afterwards in Berlin under Helmholtz. He then took up his abode as a lecturer at Kiel; being two years later made professor at the Technical College at Karlsruhe, where his most widely-known work was carried on. His investigations dealt exclusively with the relations between light and electricity; and in 1865 he had developed his electro-magnetic theory of light. This great discovery at once made him famous all over the scientific world. He succeeded Clausius in the Chair of Physical Science at Bonn in 1889; and in 1890 the Royal Society awarded him the Rumford Medal for the results of his investigations in connection with electro-magnetic radiation.

GAS-BURNERS AND THE COMPARATIVE COST OF GAS AND ELECTRIC LIGHTING.

Towards the close of last year, the *Electrician* published three articles dealing with the above subject. As they embody the results of some important original investigations, we reproduce them, with the accompanying diagrams, for which we are indebted to the courtesy of our contemporary.

In the course of the introductory remarks, it is stated that, while no exact comparison between the cost of electric light by glow lamps and by gas-burners is possible, because of the variety of the one and the gradual deterioration of the other, some better estimates may be made than the statements of enthusiastic electricians or the figures of many gas engineers. The electricians too often consider little else than volts and ampères, and concoct imaginary coal bills and wages accounts. Gas engineers, on the other hand, almost invariably take a standard Argand burner as a base for their comparisons. Tests of ordinary burners are rarely seen. The article proceeds as follows:—

We cannot, of course, afford to devote much of our space to the discussion of gas lighting; but, in view of the importance of making a fair comparison between lighting by gas and by electricity, we offer our readers an abstract of a very careful and complete report on "The Photometry of Gas-Burners," made by three students at the Central Institution of the City and Guilds of London, under Professor Ayrton. The observers were Mr. H. C. Haycraft, Mr. A. T. Weightman, and Mr. C. A. Gawthorp.

The apparatus used was the following: A Bunsen photometer, with grease-spot and mirrors; a photometric bench, about 200 centimetres long, of which a length of 150 centimetres was usually employed; a Sugg meter, placed between a regulating-tap and the burner under test, giving cubic feet per hour by observation during one minute; a pressure-gauge, placed between the meter and the burner; a Methven 2-candle standard, used without pentane; and a reflector, employed in obtaining spherical candle powers, 5 inches in diameter, mounted on an axis at 45° to its plane.

The report contains an account of the calibration of the meter by displacement of water. The first result showed that it read 0·3 per cent. too high. In other tests, in which the tap, meter, and collector were differently placed, the results were 1 per cent. too low and 1 per cent. too high; showing that, within the limits of experimental error, the meter was correct. Experiments were made to find the error due to variation of the water-level from the mark on the meter. Other necessary corrections seem to have been made, with two rather important exceptions. The barometric pressure was not recorded; and as it is remarked, in the report, that the mass of gas corresponding to a given reading of the meter may vary within about 10 per cent., the result is in favour of the consumer in fine weather. The other omission is a correction for temperature.

For determining the spherical candle powers, a 5-inch circular mirror A was mounted on a wooden frame attached to a brass tube at an angle of 45° (fig. 1). This tube rotates in a split tube

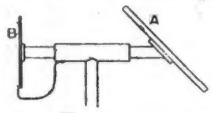


FIG. 1.

mounted horizontally, and carries at its end a disc B, divided into 5° divisions. The distance from the centre of the mirror to the vertical axis was 8 centimetres. The coefficient of absorption of the mirror was determined by the following method: A No. 6 Bray's "Special" burner was first compared with the standard in the usual manner, and then moved out at right angles to the bench; its place being taken by the mirror. The ratio of the candle power in the first to that in the second position is termed the "absorption coefficient."

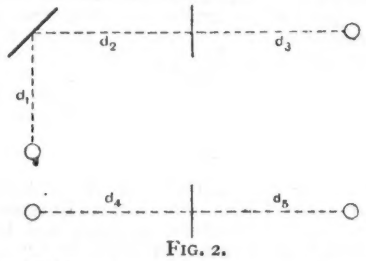


FIG. 2.

Measurement of Absorption of Mirror: d_1, distance from burner to mirror; d_2, distance from mirror to photometer; d_3, distance from photometer to standard; d_4, distance from burner to photometer, without mirror; d_5, distance from photometer to standard.

The following are a few of the observations:—

d_1	d_2	d_3	d_4	d_5	Apparent C.P.	Real C.P.	Absorption Coefficient.
34·5	94·4	47·6	111·8	38·2	14·62	17·2	1·18
30·5	79·7	62·3	99·6	50·4	6·26	7·8	1·25
30·0	97·7	44·5	113·5	36·5	16·45	19·3	1·173
30·0	66·3	75·7	87·8	62·2	3·23	3·99	1·24

The mean of a number of determinations was 1·22

The Methven standard was compared with a Harcourt pentane standard, and was found to agree very closely with it. The height of the flame of the pentane burner was adjusted by the occasional application of a spirit-flame, since the permanent height of the flame lags considerably behind an adjustment of the wick.

TESTS OF GAS-BURNERS.

The gas-burners tested consisted of Sugg's, Bray's, albocarbon, and Wenham. From one-third to one-half of the observations have been omitted in the following abstract:—

I.—*Governed Burners.*

Distance from Photometer.	Candle Power.	Cub. Ft. per Hour.	Pressure in Inches of Water.	Efficiency C.P./C.F.	Face or Edge of Flame.
Sugg's Governed Burner No. 1—					
66·5	1·270	1·33	1·70	0·957	Face.
66·1	1·245	1·33	1·70	0·936	Edge.
59·3	0·855	0·90	0·55	0·950	Face.
Sugg's Governed Burner No. 2, Table-Top—					
83·7	3·20	1·945	1·70	1·65	Edge.
84·9	3·40	1·945	1·70	1·75	Face.
83·0	3·10	1·750	0·50	1·77	"
66·5	1·25	0·950	0·16	1·32	"
Sugg's Governed Burner No. 5, Dome-Top—					
85·0	3·42	1·65	0·14	2·07	Face.
100·1	8·05	3·35	0·40	2·40	"
92·1	5·15	2·37	0·24	2·18	Edge.
107·0	12·40	4·75	1·10	2·61	Face.
104·7	10·65	4·75	1·10	2·25	Edge.
Sugg's Governed Burner No. 5, Table-Top—					
111·6	17·00	6·70	1·43	2·54	Edge.
112·9	18·60	6·70	1·43	2·78	Face.
103·8	10·00	3·75	0·50	2·67	"
81·2	2·80	1·49	0·10	1·88	"
Bray's Burner for Street Lamps, with Governor—					
99·2	7·65	3·93	1·50	1·95	Face.
99·0	7·53	3·80	0·70	1·98	"
81·3	2·80	1·50	0·20	1·77	"

II.—*Ungoverned Burners.*

Sugg's No. 1 Table-Top, Ungoverned—					
72·8	1·78	3·27	1·55	0·545	Face.
73·4	1·83	3·26	1·50	0·562	Edge.
67·4	1·33	1·40	0·60	0·953	Face.
Sugg's No. 5 Table-Top, Ungoverned—					
115·9	23·10	10·88	1·00	2·12	Face.
113·8	19·85	10·80	1·00	1·84	Edge.
110·2	15·40	5·75	0·35	2·68	Face.
85·7	3·55	1·80	0·05	1·97	"
Bray's No. 6 "Special" Batswing Flame—					
115·4	22·2	8·12	1·10	2·74	Face.
107·2	12·6	5·00	0·48	2·52	"
89·2	4·3	2·02	0·12	2·13	"
Bray's No. 6 "Special" Union-Jet—					
111·2	16·5	7·70	1·27	2·14	Face.
109·7	14·8	7·70	1·27	1·92	Edge.
108·75	13·8	5·94	0·85	2·33	Face.
91·4	4·85	2·28	0·20	2·13	"
Bray's No. 6 Patent Enamel Regulators (Batswing)—					
114·9	21·4	8·91	1·10	2·40	Face.
110·95	16·2	5·97	0·60	2·74	"
96·2	6·4	2·52	0·20	2·54	"
Bray's No. 6 Patent Enamel Regulator, Slit-Union—					
117·3	25·80	9·72	1·00	2·66	Face.
110·2	15·40	5·40	0·45	2·85	"
88·3	4·09	1·85	0·10	2·21	"
Bray's No. 6 Patent Enamel Regulator, Union-Jet—					
109·0	14·20	7·63	1·10	1·86	Face.
94·8	5·90	2·92	0·23	2·02	"
82·7	3·01	1·67	0·10	1·80	"
Bray's No. 5 "Special" Batswing—					
112·0	17·40	7·70	1·22	2·26	Face.
103·0	9·60	3·92	0·40	2·44	"
75·5	2·05	1·19	0·05	1·72	"
Bray's No. 5 "Special" Slit-Union—					
111·0	16·20	7·00	1·25	2·32	Face.
101·2	8·60	3·41	0·37	2·52	"
75·5	6·03	2·67	0·25	2·26	"
Bray's No. 5 "Special" Union-Jet—					
107·4	12·70	6·69	1·30	1·90	Face.
100·6	8·30	3·76	0·50	2·20	"
76·1	2·12	1·32	0·08	1·61	"
Bray's No. 5 Enamel Regulator, Batswing—					
109·35	14·4	7·50	1·25	1·92	Face.
107·1	12·5	5·75	0·80	2·17	"
97·8	7·0	2·98	0·25	2·37	"
Bray's No. 5 Enamel Regulator, Slit-Union—					
110·7	15·9	7·70	1·25	2·07	Face.
107·7	12·9	5·45	0·67	2·37	"
99·7	7·9	3·35	0·35	2·36	"
Bray's No. 5 Enamel Regulator, Union-Jet—					
106·8	12·2	7·25	1·25	1·68	Face.
103·8	10·1	5·40	0·80	1·87	"
97·0	6·7	3·26	0·35	2·06	"
Bray's No. 4 "Special" Batswing Flame—					
109·1	14·30	6·20	1·25	2·31	Face.
106·1	11·70	4·92	0·80	2·38	"
89·1	4·29	1·97	0·20	2·18	"
Bray's No. 4 "Special" Slit-Union—					
106·5	12·00	5·84	1·22	2·06	Face.
102·6	9·40	4·28	0·80	2·20	"
94·7	5·85	2·62	0·37	2·23	"
Bray's No. 4 "Special" Union-Jet—					
105·6	11·20	6·13	1·30	1·83	Face.
103·4	9·90	4·90	0·95	2·02	"
98·3	5·03	3·45	0·50	1·46	"
Bray's No. 4 Enamel Regulator, Slit-Union—					
110·4	15·6	7·70	1·10	2·03	Face.
108·7	13·8	6·40	0·85	2·16	"
102·5	9·3	4·68	0·40	1·99	"

Distance from Photometer.	Candle Power.	Cub. Ft. per Hour.	Pressure in Inches of Water.	Efficiency C.P. / C.F.	Face or Edge of Flame.
Bray's No. 4 Enamel Regulator, Union-Jet—					
102·6	9·3	6·95	1·30	1·44	Face.
101·0	8·5	5·30	0·70	1·61	,,
96·2	6·4	3·60	0·42	1·78	,,
Bray's No. 3 Enamel Regulator, Union-Jet—					
98·3	7·21	6·30	1·50	1·14	Face.
96·3	6·40	5·17	1·00	1·24	,,
87·5	3·92	2·62	0·33	1·50	,,
Bray's No. 3 Enamel Regulator, Union-Jet with Spong's attachment—					
107·5	12·80	6·20	1·40	2·07	Face.
98·7	7·40	3·38	0·50	2·19	,,
65·5	1·21	1·19	0·07	1·02	,,
Bray's No. 2 Enamel Regulator—					
85·8	3·57	5·06	1·40	0·76	Face.
84·6	3·35	3·99	1·00	0·84	,,
70·2	1·56	1·41	0·20	1·11	,,

From the above results, and the curves plotted from them, it is deduced in the report that—

(1) Governed burners, though their maximum efficiency is no greater than that of ungoverned ones, have the advantage of a more uniform efficiency, especially seen where high pressures are used. The candle power also remains fairly uniform for considerable changes in the pressure.

(2) Of the ungoverned burners, Sugg's appear to be more efficient than Bray's. Sugg's No. 5 table-top ungoverned burner reaches an efficiency of 2·72; while Bray's No. 5's average 2·3, and only one reaches 2·52, as maximum efficiency.

(3) Throughout the above results we see that the maximum efficiency of all burners increases with the size of the burner, *cæteris paribus;* and that even for low candle powers, it usually pays to use a large burner.

(4) As regards Bray's burners, his "Special" type has a somewhat higher efficiency than the ordinary enamel regulators; and the efficiency does not fall off so much at high pressures. Of the three types of flame—slit-union, batswing, and union-jet—the slit-union and batswing burners are considerably more efficient than the ordinary union-jet; the batswing being usually rather less efficient than the slit-union.

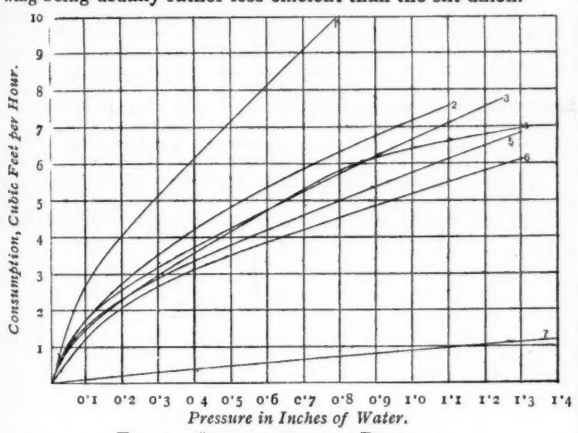


FIG. 3.—CONSUMPTION AND PRESSURE.

1. Sugg's No. 5 Table-Top, Ungoverned.
2. Bray's No. 6 Enamel Regulator, Union-Jet.
3. Bray's No. 6 "Special," Un.-Jet.
4. Bray's No. 4 Enamel Reg., U.J.
5. Sugg's No. 5, Governed.
6. Bray's No. 4 "Special," Un.-Jet.
7. Sugg's No. 1 Table-Top, Ungoverned.

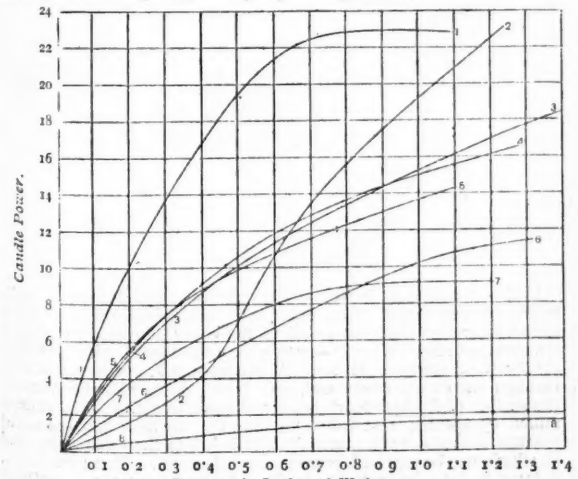


FIG. 4.—CANDLE POWER AND PRESSURE.

1. Sugg's No. 5 Table-Top, Ungoverned.
2. Sugg's "London" Argand, No. 1.
3. Sugg's No. 5 Governed Table-Top.
4. Bray's No. 6 "Special," Un.-Jet.
5. Bray's No. 6 Enamel Reg., U.J.
6. Bray's No. 4 "Special" Un.-Jet.
7. Bray's No. 4 Enamel Regulator, Union-Jet.
8. Sugg's No. 1 Table-Top, Ungoverned.

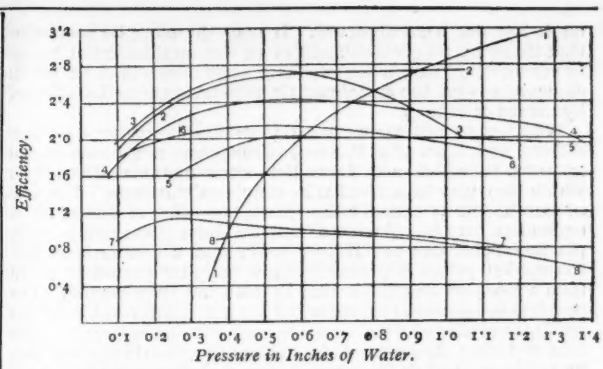


FIG. 5.—EFFICIENCIES (CANDLE POWER ÷ CUBIC FEET PER HOUR) AND PRESSURE.

1. Sugg's "London" Argand.
2. Sugg's No. 5 Table-Top, Governed.
3. Sugg's No. 5 Table-Top, Ungoverned.
4. Bray's No. 6 "Special," Union-Jet.
5. Bray's Burner for Street Lamps, with Governor.
6. Bray's No. 6 Enamel Regulator, Union-Jet.
7. Bray's No. 2 Regulator, Un.-Jet.
8. Sugg's No. 1 Table-Top, Ungoverned.

(To be continued.)

BENZOL AS A CARBURETTING AGENT.

Dr. Bunte, in his paper on "Carburetting Illuminating Gas," a translation of which appeared in the last volume of the JOURNAL (p. 717), has, from theoretical considerations, demonstrated the advantages of carburetting. Herr H. Ries, of Munich, now comes forward, in the *Journal für Gasbeleuchtung*, to give the results of practical trials on a working scale with one of the agents suggested by Dr. Bunte—viz., benzol. Subjoined is a short abstract of his paper on the subject.

The questions which arise on the consideration of the use of benzol as a carburetting agent are: (1) Does it present greater difficulties, either in its establishment or working, than the carbonizing of cannel? (2) Is it, and, if so, under what conditions, more advantageous to use benzol than cannel? To answer the first question, an experiment on carburetting ordinary gas with benzol was carried out. The gas passed through the purifiers in three streams, in one of which was inserted the carburetting apparatus fed with No. 1 crude benzol. The streams afterwards mixed; consequently the gas going through the carburettor had to be sufficiently enriched to give to the mixed gas the standard illuminating power. The gas was made from common coal only; and the illuminating power of the uncarburetted gas was observed at the outlet of the purifiers, that of the carburetted gas after the carburettor and purifiers, and that of the mixed gas after it had passed through 160 yards of main 2 feet in diameter, and the station meter. A holder of 60,000 cubic feet capacity was filled with the mixed gas, in order that the permanency of the enrichment might be tested The experiment lasted 12 hours, during which time 237,500 cubic feet of gas were produced, and 121 lbs. of benzol were used. (The specific gravity of the benzol is not stated; but the 121 lbs. may be taken as probably equivalent to about 14 gallons.) The quantity of gas passing through the carburettor was not ascertained. The illuminating power improved from the time of starting the apparatus, and was afterwards very uniform; as was also the consumption of benzol. The absolute quantity of benzol taken up by gas appears to vary with the efficiency of the carburetting apparatus.

The most primitive arrangement suffices, provided the bulk of the gas to be enriched passes through it; but where only a fraction of the whole quantity goes through the carburettor the construction of the apparatus requires forethought so as to secure the maximum amount of benzol being assimilated. An apparatus fashioned somewhat like a gas-meter, of which the drum presents to the gas a very large surface wetted with benzol, suggests itself for the purpose. The requisite degree of enrichment of the gas can then be maintained by regulating-valves, which alter the proportion of the total volume going through the carburettor. As a mean result, it was found that the gas which passed through was raised in illuminating power 4 to 5 Hefner units, and the mixed gas 2·04 Hefner units, tested in a batswing burner with a consumption of 127 litres per hour. Therefore 4 ounces of benzol were required to raise the illuminating power of 1000 cubic feet of gas by one Hefner unit. But this quantity must necessarily be different for gas of considerably higher or lower illuminating power than that experimented upon, and moreover will not be correct if the added illuminating power amounts to more than two or three candles. For common coal gas of fairly uniform quality, enriched by one or two candles only, 4 ounces of benzol is a fair average consumption for raising 1000 cubic feet by 1 Hefner unit.

At a temperature of about 59° Fahr., no separation of the benzol took place in the holder; and the carburetted gas did not deteriorate more than other gas on keeping. The effect of cold

on it has not been observed. It may therefore be concluded that there are no great difficulties in the application of benzol to carburetting gas on the working scale; and that, as far as observations go, the enrichment is as permanent as that effected by means of cannel.

Whether or not carburetting is profitable under any conditions, and, if so, what those conditions are, are questions the answers to which are dependent upon financial data, from which they may be arrived at by simple calculations. The cost of enrichment by cannel being given, the value of benzol as an equivalent may be calculated from the above given consumption per 1000 cubic feet per Hefner unit; and a comparison with the market prices will readily show whether benzol is at the time a more economical enriching material than cannel. The problem is somewhat complicated by the greater value of the residuals produced from common coal than from cannel. The cost of laying down plant for carburetting is trifling, and may be safely ignored in the computation as being more than compensated by increased ease and convenience in working.

Herr Ries deduces interpolation formulæ for arriving readily at the relative values, for carburetting purposes, of benzol and cannel at market rates; and he illustrates their use by an example. But they are valueless in their present form for use in this country, and would be quite unrecognizable if altered to fit the conditions prevailing here. Speaking broadly, the worth of benzol for carburetting is dependent upon the difference in price of coal and cannel, and the difference in quality of the two; but, generally, it will be most valuable where coal is cheap and cannel dear. For the use of benzol it may be pleaded that the quality of the tar made would be improved by ceasing to mix cannel with the coal; while the flooding of the market with benzol which now prevails would be checked by its use on the works.

Ceilings Blackened by the Electric Light.—The advocates of electric lighting have, times without number, in all sincerity assured a too gullible public that smoked and blackened ceilings would be consigned to limbo when gas was replaced by the incandescent electric light. And yet, to retain the form of an ancient saw, "all is not smoke that blackens" may be quoted in this connection as an incontrovertible proposition. It is true that the electric glow lights do not smoke, yet when fixed near an unscreened ceiling the well-known smoke rings appear with unblushing effrontery above each light. The scientific explanation of their production is so elegant an example of the deduction of cause from effect, that the electrician may perhaps now display less chagrin than he exhibited when first he beheld them appear as unwelcome haloes to his pet creation. He has now learnt that the particles of dust floating in the air are carried upwards in the current caused by the heat of the glow lamp, and are brought in contact with, and deposited upon, any surface a short distance above it—producing the effects usually attributed to smoke. It may therefore be surmised that when gas is consumed in a properly constructed burner, the soiling of ceilings does not take place to an appreciably greater extent than with the electric light.

The Emission of Heat by Gases.—The question as to whether gases are capable of emitting heat has been investigated by many physicists, most of whom, says *Nature*, have come to the conclusion that the characteristic spectra of glowing gases are chiefly, if not solely, due to some chemical action going on within the gas. Hittorf heated air in platinum tubes, a few centimetres long, over a Bunsen burner; and Siemens treated air, carbonic acid, and steam in a similar manner—using longer tubes and higher temperatures. Both were unable to discover any radiation by the gases when thus simply heated; and Pringsheim, after more recent work, came to the conclusion that emission spectra cannot be obtained by simple heating. Mr. F. Paschen has, however, quite recently succeeded in discovering and mapping such spectra by a modification of the late Professor Tyndall's experiment with gases rising from an incandescent body, substituting the bolometer for Tyndall's thermopile. The hot body employed was a spiral band of platinum forming a narrow tube, which was heated by passing an electric current through the platinum. The gases were sent through this spiral; and thus acquired a temperature of about 1000° C. The spectrum was formed by a fluorspar prism and two concave mirrors, adjustable automatically to minimum deviation for any wave-length. The gases examined were air, oxygen, carbon dioxide, and steam. Only the last two gave positive results; some small deflection in the first two being due to slight traces of moisture. Carbonic acid showed a very sharp maximum far in the infra-red. The bolometer strip was too broad to determine whether it was a line or a band; but it is most probably a somewhat ill-defined line. Steam showed about eight maxima, which must be described as bands. A comparison of the spectrum of the Bunsen flame with that of the hot products of combustion arising from it showed that the spectra obtained are similar and of almost equal intensity; so that it is very probable that the spectra of hot gases are chiefly due to temperature, and not to chemical action. A curious and hitherto unexplained observation is that of a slight shifting of the maxima towards the more refrangible end of the spectrum when the temperature is lowered.

REGISTER OF PATENTS.

Gas-Pendants.—Greenhough, G. H., of Manchester. No. 3787; Feb. 21, 1893.

This invention—applicable to gas-pendants made with a sliding tube and stuffing-box—has for its object to support the glass bell or smoke-preventer in such a way that it will always be held perpendicularly above the flame, and at a proper distance therefrom, whether the sliding tube is drawn down much or little, or even should the tube be turned partially round to throw the light to one side or the other. It consists in the combination with the sliding tube of the stuffing-box of the gas-pendant of a rod or bracket, permanently or adjustably fixed to it, and provided with a hook or other means of supporting the glass bell or "smoke-preventer."

Converting Non-Gaseous Hydrocarbons into Combustible Gas.—Siemens, F., of Westminster. No. 4022; Feb. 23, 1893.

This invention relates to a process and apparatus for converting hydrocarbons—such as petroleum, paraffin, naphtha, and other oils and spirits, fats, tars, resins, wax, naphthalene, and the like, or mixtures of any of these substances—into combustible gas, by igniting the surface of the hydrocarbons in a vessel to which (after ignition) a limited supply of air is admitted. The heat of combustion converts the hydrocarbons into combustible gas, which passes away along with the products of combustion. Whether the gas thus produced, says the patentee, be used directly or stored for subsequent use, it may be employed alone, or in admixture with other gases or vapours, with or without purification or enrichment, in fires for heating or cooking, in regenerative or other furnaces, for lighting, or for producing motive power.

In order to obtain the best results in the quality of the gas made, the inventor finds that the flame of the hydrocarbons under decomposition should be mainly of a blue colour. The gas made may be deprived of its moisture, also of some of the carbonic anhydride produced by combustion, by efficient cooling. The inflow of air to the apparatus may be controlled or promoted by an injector or fan, or by any othe well-known means; but, in cases where the gas and products of combustion pass freely away, the draught caused by their ascent in a pipe above the vessel may, it is remarked, be found sufficient to draw in the required supply of air.

The apparatus employed consists of a vessel, in which the hydrocarbons are ignited, surmounted by a vertical pipe, up which the gases ascend. Over the hydrocarbon in the vessel, a number of small holes or tubes admit air near the surface of the hydrocarbon. When liquid hydrocarbon is used, it is kept at a nearly constant level, by being supplied from a reservoir in regulated quantity. When solid or pasty hydrocarbons are used, an internal vessel containing the material may be so supported that, as its contents evaporate, the vessel rises, and thus maintains the surface of the hydrocarbons under decomposition at an approximately uniform distance from the air-inlets. For igniting the hydrocarbon in the vessel, a flame is introduced through an opening in the cover; and, if required to assist in starting the ignition, a small quantity of spirit or light hydrocarbon may be used. When the liquid is ignited, the lid on that opening should be closed.

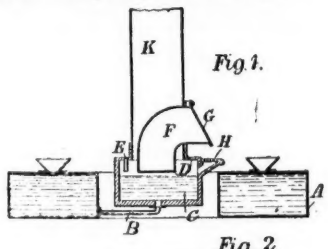


Fig. 1.

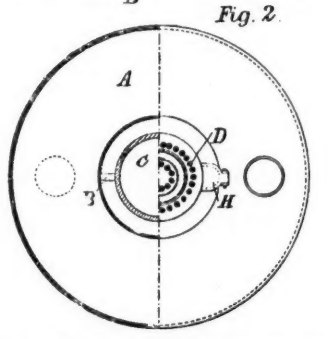
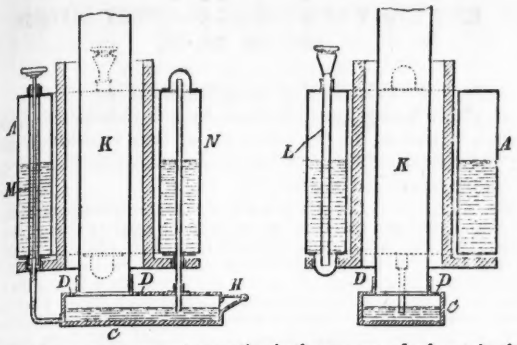


Fig. 2.

In figs. 1 and 2, A is an annular reservoir, which supplies liquid hydrocarbon (or hydrocarbon rendered liquid by heat) through a pipe B to the central combustion vessel C, the cover of which has through it a number of small holes D—or they may be tubes E, admitting air to the surface of the hydrocarbon. An elbow-pipe F, having several holes through its closed lower end, and having a door G, also admits to the surface of the hydrocarbon an additional quantity of air, as determined by opening more or less the door G. Or there may be a central passage, domed over to admit air from below to the combustion vessel C, which may be supplied from an external source. Through a door H, a taper is introduced to ignite the oil, whereupon gas is produced, which ascends the tube K, to be led to a gasholder or other receptacle, or it may be led directly for consumption to a fireplace or furnace.

As shown in figs. 3 and 4, the reservoir A is above the combustion vessel C; and it is supplied through a plugged funnel-tube L, which extends down into a cup at the bottom of the reservoir, so as to be sealed by the liquid. The vessel C receives its supply through a tube M, provided with a regulating-valve; the level of the liquid in C being kept

Fig. 3. Fig. 4.



constant by an arrangement operating in the manner of a fountain glass. A tube N admits gas to the space in A above the liquid, so as to allow the liquid to flow down to C only when the lower end of the tube becomes unsealed.

Incandescent Gas-Lamps.—Siemens, F., of Westminster. No. 4369; Feb. 28, 1893.

In the course of the specification relating to this invention, the patentee says: "In all lamps, the products of combustion pass away in a highly-heated condition; and even in those of the regenerative kind, this heat cannot be entirely utilized by the regenerators employed. The object of my invention is to utilize, for the purpose of producing light, much of the heat thus wasted—thereby increasing the illuminating power of a lamp, or proportionately economizing the gas or other fuel consumed by the lamp. For this purpose, I arrange in the path of the hot products of combustion, after they leave the luminous flame of the lamp, a network or other form of refractory material, which is rendered incandescent by the heat of the products of combustion; and thus is made to give light in addition to that given by the lamp-flame itself. When the lamp is of the regenerative kind, the products of combustion, after passing the incandescent material, being still at a high temperature, are led through suitable passages for heating the air supplied to the flame. The refractory material employed as above described, may be of the same kinds as those already used in what are known as incandescent gas-lamps, in which the incandescence is produced by the heat of a Bunsen or non-luminous flame."

Fig. 1 Fig. 2 Fig. 3.

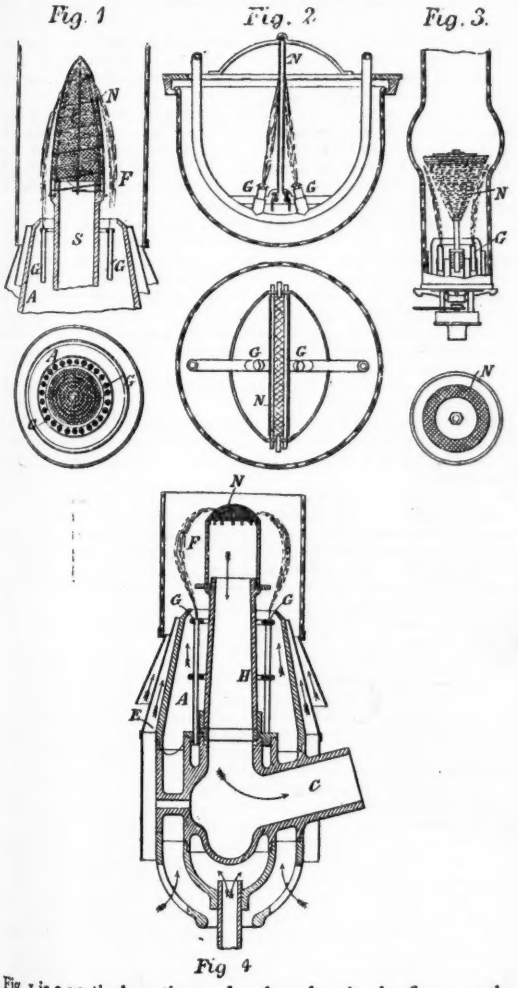


Fig 4

Fig. 1 is a vertical section and a plan of a circular-flame gas-lamp, provided with such a network of refractory material, heated by the flame. The gas issues from a number of small tubes G, circularly arranged in the passage A, which has an inwardly-projecting lip, directing the ascending air on to the root of the flame. A central hollow stem S supports a network hood N of refractory material, which is rendered incandescent by radiation from the luminous part of the flame F, and by contact with the products of combustion at its upper part, which, though non-luminous, are at a very high temperature.

Fig. 2 shows a ceiling lamp. In this case, the flames from two inclined burners G are directed on to a network screen N.

Fig. 3 refers to a lamp with a circular burner G, surmounted by an inverted network cone N.

Fig. 4 exhibits a regenerative gas-lamp, having its flame F proceeding from a row of tubes G circularly arranged in the air-channel A. The products of combustion pass through a pervious body N of refractory material, heating it to incandescence, and descend a central channel H, to a lateral outlet C, leading to a chimney. The air ascending the channels A E is heated by conduction from the metal walls.

APPLICATIONS FOR LETTERS PATENT.

398.—Cutting, H., "Gas, steam, and other fluid motors." Jan. 8.
408.—Abel, C. D., "Gas and oil motor engines." A communication from the Gas Motoren Fabrik Deutz. Jan. 8.
482.—Upton, C. S., "Gas stoves or heaters." Jan. 9.
522.—Lake, H. H., "Lighting and heating apparatus." A communication from G. Laverriere, V. Laverriere, and F. Lyghounes. Jan. 9.
534.—Carr, I., "Manufacture of illuminating gas." Jan. 10.
545.—Rosen, S., "Gas-burner." Jan. 10.
587.—Young, D., "Testing pipes and conduits, and apparatus therefor." A communication from E. Torelli. Jan. 10.
678.—Hopkins, H. L., "Gas or oil stoves applicable for advertising." Jan. 12.
694.—Horton, J., "Gas governors and apparatus for regulating the supply of gas." Jan. 12.
697.—Carroll, H. M., and Hill, G., "Stoking mechanism for gas-retorts." Jan. 12.
705.—Nuttall, R., "Improvement of all artificial lights by a more perfect distribution, deflection, and reflection of the light used." Jan. 12.
736.—Stringfellow, J. H. W., "Treatment of tar, and obtaining useful products therefrom." Jan. 12.
778.—Campbell, H., "Oil and gas motor engines." Jan. 13.
817.—Glover, R. T. and J. G., "Coin-freed apparatus for the sale of gas in fixed quantities." Jan. 13.
870.—Campbell, H., "Gas and oil motor engines." Jan. 15.
909.—Holman, S., "Atmospheric gas-burners." Jan. 15.
926.—Bramley, F. H., "Taps or cocks for regulating the flow of gases or fluids, commonly known as plug cocks." Jan. 16.
1029.—Knelle, G. St. J., "Artistically shaped fuel for use with every kind of gas-fires." Jan. 16.
1036.—Aitkenhead, J. T., and Moyle, W., "Duplex burners." Jan. 16.
1092.—Moon, H., "Automatic sale and delivery coin-freed attachments for gas and liquid meters." Jan. 18.
1171.—Main, R. B., "Gas-fires." Jan. 19.
1176.—Joyce, T., "Water-pipes." Jan. 19.
1178.—Anderson, J., "Coin-freed gas-meters." Jan. 19.
1202.—Rossiter, W., "Prepayment meters." Jan. 19.
1238.—Hancock, D., Craig, J. B., and Hancock, A. H., "Employment of air for lighting and heating purposes." Jan. 19.
1260.—Brodt, L., "Safety stopcock for gas-fixtures." Jan. 20.
1268.—Howell, E. J., "Actuating gas and water cocks or the like. Jan. 20.

Sales of Shares.—At a sale of miscellaneous shares at Wakefield last Friday week, eight fully-paid up £25 shares in the *Wakefield Gas Company* were sold for £56 each; and 44 "B" fifth £5 shares realized £9 apiece. Subsequently, 21 original £10 shares in the *Rothwell Gas Company* changed hands at £18 5s. each, and 20 additional £10 shares at £11.——Last Thursday, Messrs. W. G. Stansfield and Co., of Bradford, disposed of £2478 of 10 per cent. ordinary stock of the *Shipley Gas Company*, at £226 per cent.; £1100 of 7 per cent. new ordinary stock of the same Company, at £159 10s.; and five original £10 shares in the *Clayton, Allerton, and Thornton Gas Company*, at £16 10s. each.

Oswestry Corporation Water-Works.—The Corporation o Oswestry having applied to the Local Government Board for sanction to borrow additional money for the purposes of their water undertaking, an inquiry into the matter was held yesterday week by Colonel Hasted, R.E. The Town Clerk stated that it was proposed to borrow £2500, repayment to be spread over a term of fifty years. The total expenditure on the works had been about £20,000. It was remarked by the Inspector that practically the cost of the work had been doubled since the original estimate. There was no opposition to the application; and, at the close of the inquiry, the Inspector visited the new reservoir at Penygwely.

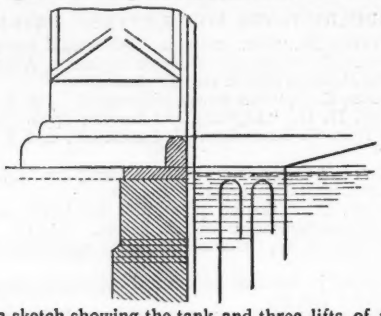
Fatal Accident at the Sheffield Gas-Works.—On the 9th inst., Joseph Dixon was engaged at the Effingham Street Gas-Works of the Sheffield Gas Company, in cleaning out an ascension-pipe. He went to the top of the pipe to take off the cap; while a man named Boldy, who was assisting him, opened the retort-lid to relieve the pressure on the cap. Flames immediately burst forth, and injured Dixon so severely that he died last Wednesday week. At the Coroner's inquiry on the following Saturday, Boldy stated that they had done the same job 20 or 30 times before during the past twelve months, without having an accident. It was necessary to have a light; but he could not say whether deceased was using one on this occasion. If he was, and it was put near the pipe, it might have caused the explosion. He had never known a blaze come out of the pipe before. Dixon worked half an hour after the accident happened. Charles Rhodes, the foreman at the works, said a sudden gust of wind might have blown the flames out; but he was of opinion the deceased held his lamp too near the pipe. A verdict of "Accidental death" was returned.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Gasholder Construction.

SIR,—In connection with the subject of the interesting article on gasholder cups in yesterday's JOURNAL, I should like to say that I have adopted what I believe to be a good plan in designing gasholders and tanks—viz., making the tank deeper than the outer lifts of the holder. The object of this is to cause the dips of the outer lifts to descend completely under water when they are down on the rest-stones. If they do not do so, then, as the inner lift descends, the gas blows out of the dip through the lowering of the water on the inside between the cup and dip. In fact, the cup carries its water down with it, and unseals the dip. I make the tank 6 inches deeper than the outer lifts; and I add 6 inches to the inner lift, to keep the top curb out of the water, and to allow space for the open ends of the inlet and outlet pipes.



I enclose a sketch showing the tank and three lifts of the new gasholder for the Bradford Road station of the Manchester Corporation in position when at rest. It will be seen that a stone curb is placed above the coping of the tank, and that the pier-stones on which the standards are erected are brought up to the level of the top of the curb. This allows of keeping the tank filled to the top edge of the flat coping. Of course, when the dips descend under the water, the water in the tank outside the dips flows over them, and replaces that carried down by the cups.

G. E. STEVENSON.

Rochdale Road Gas-Works, Manchester,
Jan. 24, 1894.

The Cost of Lighting the City of London.—An account of the estimated assets and liabilities of the Commissioners of Sewers of the City of London has just been published. The liabilities amount to £383,362. This sum included electric lighting, £18,332; and gas lighting and testing, £7500.

Accident at the Wallasey Gas-Works.—An accident of a shocking character occurred last Wednesday at Poulton, on the land now being utilized for the extension of the Wallasey Gas-Works, whereby a man named Walsh, in the employ of the contractors (Messrs. Marr and Son, of Liverpool), sustained very serious injury. It appears that Walsh was engaged removing soil from the site by means of bogie waggons and horses; and while in the act of uncoupling a loaded waggon when in motion, he slipped and fell, one of the wheels tearing off the flesh on the calf of the leg in a fearful manner. The Gas Engineer (Mr. H. Ashton Hill) happened to be on the spot, and rendered first aid. The injured man was then conveyed to the Birkenhead Borough Hospital.

The Barnsley Corporation and the Penistone Water-Works.—An explanation was made by Alderman Pigott, at last Tuesday's meeting of the Barnsley Town Council, with reference to the action of the Water Committee in declining to accept the offer of the Penistone Local Board to sell their water-works to them for £24,000, and in withdrawing the Bill which had been promoted in Parliament. He said the Committee regretted that the negotiations had resulted in a failure to carry out a scheme which at one time was thought would be advantageous to the town. In 1884, 1887, and 1893, when they were short of water, they looked to Penistone for a supply. When the negotiations to purchase were commenced, the Clerk to the Local Board (Mr. Hodgkinson) informed the Committee that they were willing to sell for a sum not less than £20,000 or more than £24,000, subject to certain agreements existing between the Local Board and the Penistone Rural Sanitary Authority, and the Darton Local Board. At the time, and at every subsequent interview, Mr. Hodgkinson conveyed no intimation that there was a clause enabling Darton to supply the neighbouring districts with water; and when this was discovered, it was pointed out to the Committee. Mr. Hodgkinson admitted that he had made a mistake, and expressed his regret, stating that he had acted in good faith, and had only recently discovered that such a licence existed. It was subsequently found that the Barnsley Rural Sanitary Authority had agreed to take water from Darton; and the Committee requested the Town Clerk to write to Penistone asking for some explanation of the difficult position in which they had put the Corporation. Mr. Hodgkinson replied admitting that the responsibility rested upon him, but that the existence of the licence was unknown to him until quite recently. Alluding to further negotiations, Alderman Pigott remarked that the Penistone Local Board sent the Committee a letter giving them a fortnight to consider the matter; but it was only received the day before the ultimatum was due. The Committee met on Dec. 30; and, after careful consideration, decided not to purchase, and therefore, as a matter of necessity, to withdraw their Bill. Under the circumstances, they felt this was the only course open to them. What they would do about the costs he did not know; but the least they could expect was that the Penistone Local Board should pay whatever expense had been incurred. A short discussion followed this statement, in the course of which remarks were made which indicated that the Council entirely exonerated the Committee from all blame.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Saturday, Jan. 27.

(*Before Mr. Justice* STIRLING.)

Re Hirschfeld's Patent (No. 2689 of 1893).

A petition having been presented by the Incandescent Gaslight Company, Limited, for the revocation of Herr Hirschfeld's patent for an incandescent light, the matter came before the Court for directions as to service and mode of trial.

Mr. MOULTON, Q.C. (with him Mr. TERRELL), who appeared for the applicants, said the patentee was a foreigner residing abroad, but he understood that a Company already formed in London, called the Deimel Light Company, had arranged to work the invention of Herr Hirschfeld. Upon them, the petition had been served; and the Company had stated that they intended to defend the action. There could be no doubt that the petition had come to the knowledge of the patentee; and, under these circumstances, he submitted that there had been sufficient service.

Mr. E. E. JENKINS appeared for the Deimel Company.

His LORDSHIP thought it would be better that notice should be sent to the patentee.

Mr. MOULTON said this should be done.

His LORDSHIP then directed that the petition should come before the Court as a witness action.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Thursday, Jan. 25.

(*Before Justices* MATHEW *and* COLLINS.)

Holme and King v. The Mayor, &c., of Stockport.

In this case, the plaintiffs, who are Contractors at Liverpool, had made a gasholder tank for the defendant Corporation; and being dissatisfied with the award of the Official Referee, to whom the action had been referred, they now asked that it might be sent back to him, or that judgment might be entered for them.

Mr. MULHOLLAND and Mr. P. MORRIS appeared for the plaintiffs; Mr. GULLY, Q.C., and Mr. BYRNE represented the defendants.

Mr. MULHOLLAND said the action was originally brought to recover the price of certain work done in connection with the erection of a gasholder tank for the Corporation of Stockport. The statement of claim only set out the contract price, which was several thousand pounds; and certain other claims were added. The Official Referee decided against the plaintiffs on their claim, and against the defendants on their counter-claim, which was for a small sum of £143; thus disposing of all the issues in the action. The way in which the claim arose was this: A large quantity of the work was excavation; and, according to the specification, the plaintiffs were entitled to leave on the gasworks all sand, gravel, and ballast excavated, and to have a place allotted to them by the defendants for the purpose. The defendants refused to permit them to deposit a large quantity of this sand, &c.; and, in consequence of this, they had to remove to tips some 12,000 cubic yards, at a cost of £760. The claim in respect of this had been wholly disallowed by the Official Referee. Having read the clause in the contract bearing upon this point, Counsel submitted that, the defendants having refused to allow the plaintiffs to deposit the sand and gravel on their premises, which was a breach of the contract, the latter were entitled to damages, which were to be measured by the expense to which they were put. The only answer to this in the statement of defence was that they did not refuse. But the Official Referee—to the surprise of everybody, he believed—found that this was an extra or addition to the contract which required a written order from the Engineer; and he disallowed it on this ground.

Justice MATHEW asked if any application was made to the Engineer when the difficulty arose.

Mr. MULHOLLAND said the Official Referee found, as a matter of fact, that the Engineer had refused to allow the deposit of this ballast.

Justice MATHEW inquired if this was not within his authority, under the contract.

Mr. MULHOLLAND submitted that there was no authority in him to break the contract; and that was what this really amounted to. The contract stated that the defendants were to find a place on their works upon which the stuff was to be placed. The clause respecting written orders referred to alterations, additions, or substitutions, which must be ordered in writing by the Engineer. It alluded to matters being done under the contract, but not to a breach of the contract.

Justice MATHEW asked if the Engineer required the plaintiff to take the stuff away.

Mr. MULHOLLAND said he did not; but he refused to allow them to deposit it on the ground, and therefore the only alternative was to take it away. It was just the same as if a person refused to take delivery of goods ordered. All the vendor could do was to sell them on the market at the best price. The plaintiffs did the only thing open to them—they carted it away, at a cost of several hundred pounds. They contended that the action of the Engineer constituted a breach of the contract, and that they were entitled to damages.

Justice COLLINS asked if it was the fact that the Engineer for the defendants would not allow them to leave it on the ground.

Mr. MULHOLLAND said it was. He read a portion of the judgment of the Official Referee on this point, in which he stated that, although Mr. Jacques, the Engineer, said at first that he did not refuse, his evidence was subject to the remark that he was not able to remember all the conversations that took place; and he thought there was sufficient proved on the other side to make it necessary for him to find that the Engineer did refuse to allow any more of this ballast and gravel to be deposited, and did not specify any other place at which it was to be put. Then he went on to say that refusing to allow it to remain was, to his mind, a varying of the contract; so that, if plaintiffs wished to recover the cost of removal, they must have the Engineer's written order.

Justice MATHEW remarked that a breach of the contract was not a variation or addition to it. Did the Engineer not tell the plaintiffs where to put it?

Mr. MULHOLLAND said he did not; he never said anything of the sort. The fact was, he appeared to have lost his temper, and told them they might take it where they liked.

Justice MATHEW asked if this was the principal point.

Mr. MULHOLLAND said he believed it was; and he thought it was a very short one. There were two others—or rather two items—which would take a great deal longer to explain; but there was only one point. This arose on paragraphs 10 and 11 of the statement of claim. About six months after the plaintiffs had constructed the dry well, a leakage was discovered, which arose from a cause for which the plaintiffs were not at all responsible. They were required to do a lot of extra work; and for this they sought to be paid. The history of the matter was this: The whole work was, of course, constructed according to the most elaborate plans; and it was concluded in May, 1890. There was some dispute as to the exact date; but no one could bring it down later than October. There was the usual clause as to twelve months' maintenance. The Engineer had not given his certificate that the work was "completed to his entire satisfaction." But the Corporation took possession, and proceeded with the erection of the gasholder in May; and, of course, for twelve months afterwards, the Contractors were liable to make good any defects. During that year a leakage took place from the main tank into the dry well; and the plaintiffs' attention was called to it. They said there was no defective work whatever. The Engineer said he thought the puddle was wrongly put in; and he made them take it out, and put it in again. This was done; and there was nothing whatever the matter with the puddle in any shape or form. They then tried various experiments, at the direction of the Engineer; and finally the leakage was only stopped by the application of cement to the interior of the dry well—a thing which had never been specified for, but was entirely new. The plaintiffs asked for the cost of doing this; and they submitted that it was for the Official Referee to say whether there was any defect in the Contractors' work, or whether it was not a default in the original plan of construction. A number of scientific gentlemen were examined on each side.

Justice MATHEW asked if the Engineer had decided this point against the Contractors.

Mr. MULHOLLAND said the Engineer had decided nothing at all; there was a change of Engineers during the proceedings. He said he did not know what was the matter; but he suspected some foreign substance had got into the puddle, and prevented it from adhering. But this was all taken out; and it was proved that there was nothing wrong with it. He then directed them to try something else. The view the Official Referee had taken on this point was this: You guarantee to give them a water-tight tank. It does not concern me what was the matter with this tank, or where the defect was. You did not give them what you contracted to do; and therefore I will not relieve you in any shape or form. He submitted that there was nothing of this sort in the contract; they only agreed to construct the works according to the plans and specifications.

Justice MATHEW said if there was no defect in the Contractors' work, it was not maintenance. That clause only applied to defective work *in situ*. Had the Engineer given his certificate?

Mr. MULHOLLAND said, curiously enough, he never gave the final certificate at all. In point of fact, the defendants dispensed with it by taking possession of the works, and erecting the gasholder.

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Mr. MULHOLLAND, continuing his remarks, said there was no finding by the Official Referee that the Contractors' work was in any way defective. A year and a half after the work was finished, the plaintiffs had, at the request of the Engineer, rendered the dry well with cement, at an expense of £144 18s.; and for this sum they were now suing. As the work proceeded, it was from time to time inspected by the Clerk of the Works, and no fault was found with it.

Mr. GULLY submitted that there was no contract by the defendants to point out a place where the sand or gravel should be placed.

Justice COLLINS asked if the Referee had not found, as a fact, that the defendants refused to allow the plaintiffs to put the sand and gravel anywhere on the works.

Mr. GULLY said the Referee had found that there was evidence on the plaintiffs' part of a demand that a place should be pointed out. It was a significant fact that the plaintiffs had never, during the construction of the work, made any complaint whatever that they had to carry away the sand and gravel. The 21st clause of the contract provided that the whole of the rubbish and earth not required was to be carried off the premises, and that all the ballast, sand, and gravel excavated and left over and above that required for the execution of the work was to be left on the ground in such places as the Engineer might direct. This was a clause entirely in favour of the Corporation, and one which they could waive. It was valuable stuff; and the Corporation could either retain it or not as they liked. The plaintiffs' claim for damages arose from the fact that the tip which they happened to get was a long way off the ground; but that could not be taken into consideration, as the contract ought not to be construed by the light of subsequent facts.

Justice MATHEW observed that the terms of the contract were very stringent, because it said that all over and above what was required for the construction of the works, was to be left.

Mr. GULLY submitted that the defendants were not contracting to take it if they did not want it.

Justice MATHEW said the Official Referee had not taken that line; he said that the Contractors could not recover unless they produced a written order for what they had done. If the plaintiffs were right in their construction of the contract, they ought to have left the ballast on the ground.

Mr. GULLY said, as to the dry well, it was essential that it should always be dry, in order to facilitate the inspection of the pipes at the bottom.

Justice MATHEW asked if the contract was not to supply a tank and dry well lined with puddle.

Mr. GULLY said he did not dispute that cement was not provided for in the original specification, though it was not correct to say that the Engineer had ordered it. It was merely put in as the result of various conversations which had occurred between the Contractors' Manager and the Engineer. By the contract the Contractors had guaranteed they would make a tank which would be effective for a year at least.

Justice MATHEW observed that the Contractors did not guarantee the effectiveness of the design.

Mr. GULLY, in conclusion, contended that the fact that the water came into the dry well after it was constructed, and that after the plaintiffs had (at the suggestion of the Engineer) re-puddled round it the quantity of water became diminished, showed that it was imperfectly puddled at first.

Mr. MULHOLLAND then briefly replied on behalf of the appellants.

Justice MATHEW, in giving judgment, said he was unable to arrive at the same conclusion as that to which the Official Referee had come—viz., that in order for the plaintiffs to recover the amount they claimed in respect of removing the sand and gravel, it was necessary to prove a written order by the Engineer for the work to be carried out. The interpretation put upon the contract by the Official Referee, as to the disposal of the sand and gravel, was clearly wrong; and on this part of the case, the amount in dispute not being agreed between the parties, the matter must be sent back to him. As to the cement which had been put on the inside of the dry well to keep out the water, that was supplied after the work had passed out of the plaintiffs' hands. In support of their contention on this part of the case, the defendants relied upon clause 9 of the contract, which stipulated that the Contractors should make good any imperfect or unsound work. The contract specified the description of puddling that should have been employed between the tank and the dry well. It was discovered, after the well had been completed, that there was a leakage of water into it from the tank. According to the evidence, the Engineer in the first instance thought that this leakage was due to some defect in the puddle; but it was clear that the Engineer was wrong in that respect. He directed the puddle to be removed and relaid; but after this had been done, the leakage continued as before, though not at the same rate. The result was that the well became filled up; and it became necessary to consider what ought to be done. The Engineer subsequently came to the conclusion that puddle was not the right thing to use; and he directed that a lining of cement should be put in the well. It had been said that this came within clause 9; but it was obvious that it did not. Then it was sought by the defendants to bring the cement within clause 25, which provided that the Contractors should be responsible for the soundness and stability of the work for twelve months after completion; and if any portion gave way, the Contractors should, at their own expense, make good, repair, and reinstate the same. It was argued by Mr. Gully that, under that contract, the Contractors were to supply a water-tight well; and in this view the Official Referee coincided. But he (his Lordship) was of opinion that they were both wrong. The Engineer, in ordering the cement to be put on the side of the well, was not ordering the Contractors to reinstate anything; he was really ordering fresh work to be done. Under these circumstances, the Contractors had a cause of action. But as it appeared the figures in respect of this head of claim had been agreed, it would not be necessary to send the matter back to the Official Referee on this point. As to the question of penalties counter-claimed for by the Corporation, as they very properly, did not press that claim before the Official Referee, he was of opinion that they ought to be bound by it.

Justice COLLINS delivered judgment to the same effect.

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(*Before the* LORD CHIEF JUSTICE *and Mr. Justice* DAY.)

Improved Industrial Dwellings Company, Limited, v. East London Water-Works Company.

The Supply of Water at the East-End during the Late Drought.

This was an appeal on a special case from Mr. Rose, the Magistrate at the Thames Police Court, who had dismissed a summons, taken out against the defendants, seeking to inflict penalties upon them for not supplying water to the inhabitants of Morrison Buildings South in August last, according to the provisions of the Water-Works Clauses Act, 1847. But this Act exempts water companies from penalties in case the default arises from "unusual drought or other unavoidable cause or accident;" and the Magistrate held that such was the case here. The previous proceedings were reported in the JOURNAL for Sept. 12 last (p. 492).

Mr. FINLAY, Q.C., and Mr. NEWSON appeared for the appellants; Sir R. E. WEBSTER, Q.C., M.P., and Mr. BRAY represented the respondents.

The special case, setting out all the facts and the sections of the Act relied upon, having been read, as well as the Magistrate's judgment,

Mr. FINLAY submitted that the decision was not brought within the exception, because, though the Magistrate found that there was a deficient supply on the days named in the summons, he said it was, in his opinion, due to the "unusual drought, or to the extraordinary consumption of water in the district." He (Mr. Finlay) contended that this was an alternative finding, and that the second alternative was not within the exception.

The LORD CHIEF JUSTICE suggested that the "or" might be read "and;" and that, in any case, the *causa causans* of the extraordinary consumption wa sthe drought. One must use a little common sense in these matters.

Mr. FINLAY said it came to this—that, whenever there was unusually hot weather, and the public really required more water, the Company were to be relieved o ftheir obligation to supply it.

The LORD CHIEF JUSTICE said whenever a similar year to 1893 recurred they would have to consider it.

Mr. FINLAY having shortly urged the same point further,

The LORD CHIEF JUSTICE, without calling upon Counsel for the respondents, gave judgment. He said it appeared to him that the

Magistrate had decided quite rightly, and that his judgment was a very sensible one. It was a matter of common knowledge that last year was an unusually dry one; and, besides, it was for a great length of time an unusually hot year. The two things together produced a scarcity of water. The drought was caused by the hot weather; and, in consequence of the hot weather, people wanted to drink more water. Without the drought, this desire would not have arisen in the way it did. The Magistrate further found that the Company had done all in their power to meet the case, that they could not succeed because of the unusual drought, and that the deficiency of water was occasioned by causes over which they had no control; and he therefore dismissed the summons. He was quite right; and the appeal from his decision must be dismissed.

Justice DAY concurred.

Sir R. E. WEBSTER said he did not know whether it was necessary to ask for the costs; but he submitted that he was entitled to them.

The LORD CHIEF JUSTICE said "Yes." He added that he did not wish to say anything at all hard, but it struck him that this was a slightly vexatious attack on the Company.

The Queen v. Barber.—The Public Lighting of Eckington.

Application was made to their Lordships to-day to make absolute a rule *nisi*, granted on the 11th ult. (see JOURNAL for Dec. 19, p. 1131), for a *quo warranto* calling upon Frederick Barber to show by what authority he claims to exercise the office of Lighting Inspector under the Watching and Lighting Act, 1833, in respect to the part of the parish of Eckington, in the county of Derby, which is situate within 200 yards of the centre of the several streets, roads, or thoroughfares wherein gas-mains had been laid on Oct. 5, 1893, and also the main thoroughfare leading from Eckington, through Renishaw, to the boundary of the parish, on the following grounds: (1) That the Chairman of the meeting, held at 7 p.m. on Oct. 5, 1893, was not elected by the ratepayers present at such meeting. (2) That the said Chairman was disqualified from acting by reason of his interest as Chairman of the Eckington Gas Company. (3) That persons other than ratepayers were present at the meeting. (4) That the requisition to convene the first meeting on the above-named date was bad, as purporting to be made by ratepayers of the parish generally, and not by the village only. (5) That the right to convene the second meeting was bad, as purporting to be made by ratepayers of the parish generally, and not of the part affected; and that such requisition was, in fact, signed by ratepayers of that portion of the parish where the Act was already in force. (6) That, the second meeting not being a meeting of parishioners duly convened, the resolutions adopted thereat were invalid. It appeared that the meeting in question adopted the Watching and Lighting Act, and proceeded to erect lamps; but it was said that the only persons who benefited by them were persons who wished to go to Eckington from the Midland Station, whereas most of the people wanted to go from the station in the direction of Sheffield and Chesterfield. It was alleged that the meeting in question was called for the purpose of enabling the Eckington ratepayers to override the wishes of the ratepayers of Renishaw; and the result had shown that it was the interests of Eckington which were considered. It was under these representations that the rule *nisi* was obtained.

No Counsel being present to represent Mr. Barber,

Mr. GLENN asked that the rule might now be made absolute.

The application was granted.

Charge of Stealing from a "Penny-in-the-Slot" Gas-Meter.—At the Southwark Police Court last Thursday, James Maloney, 17, and Ernest Sales, 17, were charged with breaking open the receiver of a gas-meter at the Joseph Working Boys' Club, Camberwell, and stealing about 10s., in bronze money, belonging to the South Metropolitan Gas Company. The accused are members of the club, which is supplied through a prepayment gas-meter. Last Wednesday it was found that the meter had been forced open, and the contents abstracted. Suspicion fell upon the prisoners, and they were arrested. They made no answer when charged; and Mr. Biron directed a remand.

The Delivery of Water at High Levels in London.—In view of the petitions lately received by the London County Council with regard to the limit of height to which the East London Water Company are bound to deliver water, the Water Committee, at the meeting of the Council last Tuesday, reported that they had passed a resolution to the effect that advantage should be taken of the promotion of any Bills by the London Water Companies, to procure the amendment of the existing provisions in this respect, and also of those now regulating their charges for high-service supply; and that they had forwarded the resolution to the Parliamentary Committee of the Council for their consideration in connection with the Bills now coming before Parliament.

The Frimley and Farnborough District Water Company.—The first ordinary meeting of this Company was held on the 20th inst. The Directors submitted a report which stated that the Royal Assent to the Company's Act was given on July 27 last. The Engineer (Mr. H. U. M'Kie) had since that date been engaged in preparing plans, specifications, &c., for the works; and the Directors had been in negotiation with Messrs. John Aird and Sons, who were willing to contract to carry out the works for a sum within the Engineer's original estimate of £21,780. The prospectus to be issued had been prepared with great care, and was now awaiting the final settlement of a few matters before it was sent out to the public. The total number of shares taken by the proprietors promoting the Company was 203 of £10 each, making £2030, of which £874 had been paid up on deposit and calls. The cost of obtaining the Act was £1447. In the course of the proceedings, the Chairman (Mr. A. C. Pain) mentioned that there were at present 19 shareholders, representing rather more than £7000 altogether. He further announced that it would not be necessary to issue more than about £20,000 of capital, in addition to the amount already placed, to carry out the works, which would not all be required at once, but only as the works proceeded. The report was adopted.

MISCELLANEOUS NEWS.

MANCHESTER HYDRAULIC POWER SUPPLY.

Manchester is extensively occupied with new schemes and undertakings. The greatest of these—the Ship Canal and the Thirlmere Water-Works—have made some stir in the world; but, important as they are, they do not represent the full measure of municipal activity in the city. We have already made some reference to the electric lighting installation, and to the extensions which are being carried out, or are in contemplation, at the various gas-works. There is, however, another scheme which has received little attention as yet, though in its way it is of considerable importance, and marks a distinct advance in municipal enterprise. This is the hydraulic power system, which is to be inaugurated this week, and the object of which is to supply motive power in the business parts of the city.

Long before the Corporation took the matter in hand, attempts were made by private companies to obtain parliamentary sanction to supply hydraulic power in Manchester. These were opposed by the Corporation—not only because they are the water-supply authority, but also because they wished to retain full control of the streets, and to prevent outside interference with them. Having caused the abandonment of these projects, the Water-Works Committee gave some consideration to the subject at the close of the last decade; and early in 1890, they came to the conclusion that it was desirable for the Corporation to supply water under pressure, and recommended an early application to Parliament for such powers as might be necessary. The Corporation endorsed the views of the Committee; and when the Manchester Corporation Bill of 1891 was deposited, it contained a clause dealing with the matter. This clause, as finally adopted, reads: "The power conferred upon the Corporation by section 96 of the Manchester Corporation Water-Works Act, 1847, to supply any person with water for other than domestic purposes, at such rent and upon such terms and conditions as shall be agreed upon between the Corporation and the persons desirous of having such supply of water, shall extend to the supply by the Corporation within the city, by agreement, of water under pressure, for the purpose of supplying motive power by hydraulic pressure for any purpose to which such power is applicable, and such supply shall be deemed a part of the water-works undertaking of the Corporation."

Provision was also made by the Act for a capital expenditure, under this section, of £100,000. Mr. Corbet Woodall, M.Inst.C.E., was early retained as Consulting Engineer; and the works, which are now fast approaching completion, have been carried out from his designs and under his superintendence. Having obtained the necessary powers, the Sub-Committee who had charge of the undertaking proceeded to purchase a site for the works. This they found in Gloucester Street, which is within convenient distance of the area proposed to be supplied. Some 4240 square yards of land are available for the purposes of the station; and, roughly speaking, two-thirds of this has been utilized for the first installation—the remainder being reserved for extensions.

For the purpose of the present supply, there have been erected an engine-house, boiler-house, offices, and workshop. The station adjoins the Rochdale Canal; and the arrangements are so designed that the coal supply can be handled with ease and facility. When the coal comes in the barges, it will be lifted by a 20-cwt. hydraulic crane, and tipped into the coal-store. By means of an elevator of the ordinary type, it will then be raised into a trough, and carried forward by an endless screw to the hoppers of the mechanical stokers. These operations will also be carried out by hydraulic power; duplicate motors being fixed in the boiler-house to drive the machinery. Five double-flued steel-boilers, of the Lancashire type, have been erected. These are each 7 ft. 6 in. in diameter, by 30 feet long, and are fitted, not only with the mechanical stokers already referred to, but with large economizers in the flues. Provision is made for the erection of six engines. Two of these are already completed; and two more will, it is expected, be built within the next month. The erection of others will be deferred until the need of them arises. The engines are of the three-cylinder vertical, triple-expansion, condensing type. The high-pressure cylinder is of 15 inches diameter; the intermediate, 24 inches; and the low, 36 inches—all by 2-feet stroke. The pump-plungers are 4½ inches diameter by 2-feet stroke. When the four sets of engines are erected, they will be capable of delivering 230 gallons per minute, against a pressure of 1120 lbs. per square inch, with a steam-pressure of 120 lbs. to the square inch, when running at a piston speed not exceeding 240 per minute. There are two accumulators, each with rams of 1 ft. 6 in. diameter, and 23-feet stroke. In each case the wrought-iron weight-case is filled with 100 tons of glass furnace slag, in order to give the required pressure. The pressure which will be maintained in the mains will be at least 1000 lbs. to the square inch; while at Liverpool, where a similar service is maintained by a private Company, it is 850 lbs.

At Manchester, the water supply will be taken solely from the Corporation mains; and it will, therefore, be of exceptional purity. It is stored in three big tanks over the boiler-house. Every possible arrangement is made by the duplication of parts, so as to prevent any possible cessation of power. Even the engines are so designed that, if anything goes wrong with the valves, these can be disconnected, and the engines run as if they were of the ordinary high-pressure type. The working of the engines is, to a large extent, automatical. When the accumulators are raised to the top, they close the throttle-valves, and stop the engines; while directly the accumulators begin to fall, they open these valves, and the engines start immediately.

So far between seven and eight miles of mains have been laid in the principal streets in the centre of the city; and it is the intention to extend these, from time to time, as a paying demand is developed. The largest mains are 6 inches diameter; and they range downward to 1½ inches. They are all cast-iron pipes, tested to a pressure of 3000 lbs. per square inch; and they are united by spigot and faucit joints, with overflanges connected by two bolts—the joints being made tight with rings of guttapercha cord. All cylinders, rams, pipes, valves,

and other apparatus subjected to the pressure from the mains are also to be tested to 3000 lbs. per square inch.

It is intended to maintain a constant pressure, day and night, and on Sundays and other holidays. One of the requirements of the Corporation is that each consumer shall be considered bound one year, and subject to three months' notice to discontinue the supply. A charge of about 5s. per quarter will be made for the meters. The minimum charge is to be £2 per quarter for 4000 gallons or under; and 5s. will be charged for each 1000 gallons up to 30,000 gallons. A reduced scale then comes into operation: For 50,000 gallons, the price will be £12 10s.; for 100,000 gallons, £20; for 125,000 gallons, £22 16s. 3d.; for 150,000 gallons, £25 12s. 6d.; and so on to 300,000 gallons, for which the Corporation will charge £42 10s.

The new works will make an encouraging start. About thirty machines were ready to be connected—including packing-presses, intensifiers, passenger lifts, goods lifts, and wall cranes. By means of the intensifiers, which embody a simple arrangement of differential rams, the initial pressure of 1000 lbs. can be trebled on the premises of the consumer. In Manchester, a considerable number of hydraulic presses are in use in the packing warehouses; and it is, of course, anticipated that the private installations will now give place to the public and more economical and efficient service. Arrangements have been made for the establishment of a show-room in connection with the offices. In this, there will be displayed various types of small motors and other appliances, with models of those which are too large to be thus exhibited. The Corporation are also erecting a passenger lift operated by hydraulic power; and as the offices are only two storeys high, this will be mainly for exhibition purposes also. Altogether the Water-Works Committee have gone into the matter thoroughly, and deserve credit for the manner in which they have carried out the undertaking. Much of this credit attaches in a special degree to Alderman Sir John Harwood, the Chairman, and to Mr. Alderman Leech, the Deputy-Chairman of the Committee. The latter especially has devoted much time to the scheme. The engines have been erected by the Hydraulic Power Company, Limited, of Chester; the boilers, by Messrs. Yates and Thom, of Blackburn; and the economizers, by Messrs. Green, of Wakefield. The buildings were erected by Messrs. W. Southern and Sons, of Salford.

THE GAS QUESTION IN DUBLIN.

A Newspaper Controversy.

The publication of Alderman Gill's defence of the Alliance and Dublin Consumers' Gas Company, of which an abstract appeared in the JOURNAL last week, has led, as might have been expected, to a newspaper controversy on the subject, some points in which call for notice.

Mr. Mayne, a former member of the City Council, was the first to take up the question; and his letter to the *Freeman's Journal*, defending the Corporation Gas Examiner, has been already given (*ante*, p. 160). In the course of his letter, Mr. Mayne, it may be remembered, complained that the photometer employed by the Company was one of the old Evans type, whereas that used by the Coporation Gas Examiner was one of the best and most modern that could be procured; and he asked Alderman Gill how he could expect testings made on two instruments so dissimilar to agree. To this letter Alderman Gill replied as follows: "The Gas Company are bound, by Act of Parliament and by the recent award, to use the Evans photometer, which is, and always has been, in the official testing-station. If the Corporation think otherwise, it has a simple remedy. It can take the necessary legal proceedings to compel the Gas Company to use instruments of the type mentioned by Mr. Mayne. For months past Mr. Thomas Cotton can have been using no other testing instruments except those so much praised by Mr. Mayne; as he has not tested in the new official testing-station since it was opened on the 1st of June last. How is it that, up to quite recently, he very seldom published tests less than 15 and some decimal candles, and often over 16 candles, while for some weeks past he has constantly published testings as low as 13 and even 12 candles? As a member of the Works Committee of the Gas Company, I know that exactly the same materials have been used in the manufacture of the gas for years past."

Mr. Mayne's letter was also replied to by Mr. W. F. Cotton, the Secretary and General Manager of the Gas Company, in the *Freeman's Journal* of the 20th, as follows:—

In the letter of Mr. Mayne, given in your issue of yesterday, the following erroneous statements appear in giving the results of an interview a deputation of the Gas Committee (of whom Mr. Mayne was one) had with Mr. Chaney, the chief officer of the Standards Department of the Board of Trade. "He asked what type of instrument the Gas Company had actually provided in the official testing-room, and when told it was an old Evans photometer having moveable candles, he said the Board of Trade could not verify, or recognize in any way, instruments of that type; that they were 'obsolete and unreliable;' and that two competent gas examiners testing the same gas with old instruments of that type might easily get a difference of one or two candles in their returns. I was a member of this deputation, and was astonished at these statements made by so high an authority."

On reading the above statement, I concluded that he was either labouring under a delusion, or must have misunderstood Mr. Chaney, which seems hardly possible, as the interview only took place in September last. Feeling that no man possessed of any practical knowledge of the Evans, or any other type of photometer, would make such a statement, I immediately communicated with that officer—giving a full copy of the above paragraph; and he replied that he "never made the statement as contained in telegram to anyone, and it is totally incorrect." It is also totally incorrect to say that "Mr. Chaney asked what type of instrument the Gas Company had actually provided in the official testing-room," considering that not many days previously he had been informed of the exact type of photometer. How will Mr. Mayne reconcile the fact that this same instrument—the Evans photometer—that was in use in the old testing-station for years before the Arbitrators (one of whom represented the Corporation) visited that station in 1889 to examine the instruments, which were condemned previously by the Inspector of Public Lighting a few months after that officer was appointed in 1888, is the same type of instrument which has been clearly and distinctly decided upon by the Arbitrators as the one complying with the Company's statutory obligations; and therefore they stipulated in the award that this type of instrument should be used in the new testing-station? Mr. Mayne will not venture to assert that, at the date when the instruments were condemned by the Inspector of Public Lighting, after his few months in office, that officer had any practical experience of photometers or photometry.

Intentionally, or otherwise, Mr. Mayne's letter conveys the impression that the tests made in presence of the Sub-Committee of the Paving and Lighting Committee, commented upon by Alderman Gill, were made on the Evans photometer with moveable candles; and in this way he tries to account for the discrepancy which occurred on that occasion between the two officers. Such, however, was not the case. The experiments were made on the Letheby photometer, in the old testing-station, with stationary candles; Dr. Tichborne making the first test, the Inspector of Public Lighting following with his on the conclusion of Dr. Tichborne. I maintain that whether the tests conducted in presence of the Committee were made on the Evans photometer, with moveable or stationary candles, or on the Letheby photometer, the discrepancy of close upon 2 candles could not occur within a few minutes had the tests been properly carried out by both officers.

It is hard to understand what Mr. Mayne means by inferring that the instruments are "obsolete and unreliable." How can they be obsolete so long as the Act of Parliament under which they are constructed remains in force? And as to their being unreliable, this could only be the case when the instruments are not carefully constructed, and the appliances not properly adjusted.

Mr. Mayne states that none of the Committee had ever seen gas tested before. They were "not even amateurs in the art or science of gas testing; and, further, knew nothing whatever of the elaborate calculations that have to be made after the testing is apparently over." Mr. Mayne's statement may be perfectly true; but it is quite evident he is in a similar position himself when he speaks of "elaborate calculations," as the necessary calculations only take from a minute to a minute and a half.

I think I am right in stating that Mr. Mayne has been an active member of the Gas Committee. Under these circumstances, it is hard to understand his anxiety to have the Company's instruments stamped, seeing that he must be aware that of the 23 photometers used in London, under the authority of the Gas Referees, who are the highest authority in the kingdom, not one of the photometers has been stamped, and that very few of them are of the same type. I may also mention that neither have the photometers in use in Manchester, Birmingham, Nottingham, Liverpool, Belfast, Londonderry, and the majority of towns been stamped—the stamping being looked upon as valueless.

The following is Mr. Mayne's reply to Alderman Gill's letter given above:—

Alderman Gill, in his letter, conveys, I am sure unintentionally, a very erroneous reading of the Gas-Works Clauses Act, 1871, and of the award which compelled his Company to erect the new testing-station in Tara Street. He says these authorities compel the Company to "use the Evans photometer, which is, and always has been, in the official testing-station." Neither the Act of 1871 nor the award compels anything of the kind. All Acts regulating the testing of gas, including the Act of 1871, as well as the award, provide for a proper and reliable test, on instruments which were the best of their kind at the time the Acts mentioned were passed. In none of them is there any sanction or mention of the instrument "which is, and always has been, in use in the official testing-station" in Dublin. The Gas Company's own Act of 1866 binds the Company to provide "proper and sufficient" apparatus for the testing of their gas at the official station; and that section of their Act has not been repealed or lessened in force in any way by the Act of 1871. No person knowing anything of photometric apparatus could contend for a moment that an old Evans instrument, having moveable candles and other defects, is a "proper" or "sufficient" means of testing for illuminating power.

Surely, if gas is to be tested at all, the test ought to be an accurate one, or at least as accurate as possible; and when instruments can be obtained, the accuracy of which would be certified by the Standards Department of the Board of Trade, the highest authority in the Empire, does it not occur to Alderman Gill that it is almost a contemptible position for him to be forced into occupying—that of defending before the public the use of an antiquated instrument, on which an accurate test is impossible, except by chance? Alderman Gill makes the position worse by inviting the Corporation to take legal proceedings against his Company to compel them "to use instruments of the type mentioned by Mr. Mayne." The type of instrument I have mentioned is any type that the Standards Department will certify and stamp; and let me put before Alderman Gill how this proposition of his must appear before the public. He and his brother Directors are engaged in the sale of an article the value of which depends on its quality. The duty of testing the quality of this article is thrown on the Corporation, who must appoint a gas examiner to perform this duty at an official testing-station, to be provided by Alderman Gill's Company. This officer complained of the unreliability of the means provided by him and his brother Directors for the performance of this work; and the Corporation ask them to submit those means to the examination of the authority provided by the State for such purpose. One would expect, from what we know of Alderman Gill and his brother Directors, that the moment a doubt was cast on the accuracy of the means they provided for testing the quality, and therefore the money value, of this article which they sell, he and they would be the first to put themselves right before the public by immediately submitting the instruments complained of to this high authority

for certification. Instead of doing so, Alderman Gill sneeringly invites the Corporation, who have no interest but that of performing their statutory duty in protecting the public, to take legal proceedings to compel him and his co-Directors to do that which they should have done voluntarily.

The most extraordinary circumstance, perhaps, in this correspondence is Alderman Gill's complaint, in his original statement, that the Corporation Examiner published different results from those obtained on the Gas Company's apparatus, while he now defends the retention and use of this condemned apparatus, which must perpetuate the differences he complained of.

At this stage of the controversy, a new figure—that of Professor C. R. C. Tichborne, LL.D., F.C.S., &c., the Board of Trade Gas Examiner—came upon the scene. The following letter from him appeared in the *Freeman's Journal* on the 22nd inst. :—

As far as possible, I do not wish to mix myself up with the contention now going on between Mr. Mayne and the Gas Company: but I think, as a neutral official, I should not be doing right if I neglected to point out a *via expedita* in determining the contention.

The present question in dispute seems to be the instruments upon which the tests are taken—that is to say, what are the instruments laid down by the Arbitrators appointed at the proceedings some few years ago. Everyone acquainted with these proceedings knows that all instruments used in Dublin must be of the kind specified in the award. The Gas Company say the instruments provided at the official testing-station do conform with the requirements as laid down by the Arbitrators. Mr. Mayne says they do not. Now, is it not very easy to determine this part of the subject if it is approached from a business point of view? Let two members of the Paving and Lighting Committee, two of the Gas Directors, myself, and the Inspector of Public Lighting, meet and examine these instruments in connection with the requirements of the award. I venture to think that we shall arrive at a conclusion in less than an hour. But assuming that we fail to come to an agreement, what is to prevent us having the instruments photographed, and the photographs forwarded, with exact measurements, to the Arbitrators, to answer the simple question: "Are these the instruments they selected?" I think this would be a better method than spending the money of the ratepayers in litigation.

In conclusion, I wish to add a word in connection with a personal matter. Mr. Mayne said (in speaking of the visit of the Paving and Lighting Committee to the testing-station): "They went ostensibly to see how the two Inspectors did their work, and to sit in judgment upon them." This is certainly very misleading, because, as the Paving and Lighting Committee will tell him, the meeting of myself and that Committee was purely accidental. They came in while I was testing; and I had no idea that I should see them, or they me. Lord Mayor Shanks asked me if I had any objection to explain the instruments. I did so, and took a test—describing the process as I went along. At the conclusion, as it was evident that they wanted to hold an investigation, I retired, returning later to finish my work. I was not present, therefore, and had nothing to do with the disagreeable scene which took place between Mr. T. J. Cotton and his Committee. I need hardly state that I should have been only too delighted to meet the Corporation Committee to clear up this and other points; but, on the occasion mentioned, it had not been so arranged. I had frequently asked the Gas Committee of the Corporation to do so; but they had always declined.

Next came letters from Alderman Gill and Mr. W. F. Cotton, in reply to Mr. Mayne's last letter. The former gentleman charged Mr. Mayne with inaccuracy in the statements contained in his last paragraph. "If," said Alderman Gill, "he read my last letter, even without very much care, he would see that my meaning, clearly expressed, was that Mr. Thomas Cotton has been using only the Corporation instruments (those so much praised by Mr. Mayne) since June 1, 1893; and that from that date up to some weeks ago, he seldom published testings less than 15 and some decimal candles, and often over 16 candles, while lately he has frequently published them as low as 13, and even 12 and some decimal candles—that is, he has made the testings, taken by the same instruments, chosen by the Corporation, vary as much as 4 candles from each other. I know that during all this time the same materials were used in making the gas. It was on account of this that I considered there was practically an accusation of fraud made against me and the other Directors of the Gas Company, as I said in the statement I published, which the Municipal Council refused me permission to make."

Mr. W. F. Cotton's letter was as follows :—

In Mr. Mayne's last letter, it appears, that he not only undertakes to pose as an authority upon gas apparatus and gas testing, but also as a correct exponent of the Acts of Parliament relating to gas. He states that "Alderman Gill conveys in his letter a very erroneous reading of the Gas-Works Clauses Act, 1871, and of the award of 1889, which compelled his Company to erect the new testing-station in Tara Street." Alderman Gill did not make the statement on his own authority. He has been well fortified with the opinions of most competent authorities on the subject. However, notwithstanding Mr. Mayne's opinion, we are informed that the apparatus provided by the Company is strictly in keeping with the conditions of the Act of 1871 and the award. Part 1 of Schedule A of the Gas-Works Clauses Act, 1871, clearly and distinctly prescribes that the photometers to be used in testing the gas shall be a "Letheby open 60-inch photometer, or Evans's enclosed 100-inch photometer, together with a proper meter, minute clock, governor, pressure-gauge, and balance." The award defines "that the photometers to be used shall be of the type known as Evans's enclosed 100-inch photometer, having a Keates candle-balance, together with the other apparatus described in Part 1 of Schedule A of the Gas-Works Clauses Act, 1871."

Mr. Mayne is right in his contention when he says that "all Acts regulating the testing of gas, including the Act of 1871, as well as the award, provide for a proper and reliable test, on instruments which were the best of their kind at the time the Acts mentioned were [illegible]as " and I challenge him to point out, if he is in a position to do so, if in any way, or in what particular, the photometers in Tara Street differ from the photometers referred to in the Act of 1871 and the award, or, as alleged, are defective, or to point out any cogent reasons why proper and reliable tests cannot be made on the instruments.

The Company have provided proper and sufficient apparatus for the testing of gas at the official testing-station—in fact, more apparatus than they were bound to furnish. If Mr. Mayne is of the contrary opinion, I presume he will state in what respect we have failed. This is merely requiring Mr. Mayne to do what the Gas Committee were asked to do so far back as the year 1888, when they alleged, on the report of an inexperienced officer, that the Evans photometer was defective, and of an unsuitable and discarded type.

For the information of Mr. Mayne, I may inform him that all Evans photometers in use prior to, and for long after, the passing of the Act of 1871 had moveable candles; and even recently the Gas Referees of London, when giving instructions to the gas examiners relative to the plumb-lines for plumbing the candles, remarked that their directions referred to the form of photometer prescribed by them in all recently erected testing-places—viz., "a photometer having the position of the candles fixed—and the disc moveable—and do not apply to those box photometers [Evans photometer] in which the disc is fixed and the candles are moveable."

I assert that any duly qualified expert on gas testing can perform as accurate tests on an Evans photometer, having moveable candles, similar to the Evans photometer in the testing-station, as it would be possible for him to obtain on an Evans photometer with stationary candles.

It is clear the object the Gas Committee and Mr. Mayne have in view is to force the Company to use instruments contemplated neither by the Act of 1871 nor the award.

I cannot conclude without calling attention to Mr. Mayne's remark, at the commencement of his letter, that the Company were compelled to erect the new testing-station in Tara Street. Mr. Mayne is well aware that the Company were not compelled to erect the testing-station. In the original reference agreed to, and submitted to the Arbitrators, neither the site for, nor the building of a new testing-station was introduced. The Arbitrators had no power under the reference to oblige the Company to build a station. They were merely asked to say whether or not the site of the then testing-station was a proper one. While the Arbitrators were waiting to take evidence in the case, the Directors, in order to meet the views of the Gas Committee, volunteered, at the request of that body, in the presence of Mr. Mayne, to build a testing-station in Tara Street, provided the Arbitrators approved of the site.

Mr. Mayne replied to Mr. Cotton's letter on the subject of the Chaney incident. As the deputation consisted of Alderman Toole, Mr. Robinson, Mr. T. J. Cotton, and himself, he applied to those gentlemen on the matter; and they stated that their recollection of the interview exactly corroborated his own statement. Passing on to deal with the photometer question, he said :—

In the regulations as to photometric instruments published on May 1, 1892, by the Standards Department of the Board of Trade, which I have now before me, on p. 6 occurs the following: "An Evans photometer having a moveable candle-holder will not be certified." This is exactly what the chief of that department told the deputation—telling them, in addition, the reasons why the Board of Trade had found it necessary to publish the above regulations. The next time the Secretary and Manager of the Gas Company seeks a contradiction from a Board of Trade official, I would suggest that he gets their own published regulations included in the process; it would then be so much more complete. . . . The statement of the Gas Company that this condemned Evans photometer is in compliance with the Act of Parliament will not hold water. The words of the Act are: "Improved Letheby or Evans photometer." The Evans photometers that are now made in compliance with that Act are really reliable instruments, embodying all "improvements" up to date. Evans photometers made nearly thirty years ago—such as the one the Gas Company seek to force on the Corporation—do not comply with the definition "improved" given in the Act in question. The reference to the 23 photometers used in London, which he mentions as not being stamped, is rather unfortunate for his case, as the reason they are not stamped is because they have to be certified by the Gas Referees, who, he states, are the "highest authority in the kingdom." These gentlemen being Board of Trade officials, stamping by the Standards Department is considered unnecessary.

Mr. W. F. Cotton promptly answered the assertions in the foregoing letter as follows :—

Mr. Mayne says that my statement that "the Evans photometer is in compliance with the Act of Parliament" will not "hold water;" and to endeavour to make this appear, he quotes that portion only of the schedule to the Act of Parliament defining the instruments which suits his purpose. He further implies that these words apply to any instruments constructed after the passing of the Act, notwithstanding that they may differ in form and construction from the instruments contemplated at the passing of the Act in 1871. He carefully avoids giving the date of the Act; leaving his readers under the impression that it is a recent enactment. The words of the Act of 1871 are that the instruments "shall consist of the improved form of Bunsen's photometer, known as Letheby's open 60-inch photometer, or Evans's enclosed 100-inch photometer."

It is clear that the word "improved" applied to the improved photometers then in use, which were often undergoing serious alterations, but does not apply to photometers that may have been constructed subsequently, no matter how variable in form. His contention amounts to this—that a gas company working under the Gas-Works Clauses Act (the General Act of 1871) are bound to adopt every alteration which may be made from time to time in the construction of the Evans photometer. He will be a long time before he succeeds in getting any eminent Counsel to put this construction on the Act.

We do not require Mr. Mayne to tell us that the Board of Trade will not stamp an Evans photometer with moveable candles; but this is because they have selected two forms or types of photometers—an

Evans and a Letheby—patterns from which they will not depart; but they have no power whatever to compel the use of them.

The real reason why the Gas Referees have not got the 23 photometers in London stamped is because they are aware that no amount of stamping will keep the instruments in order, and because the officers in charge of the instruments are competent to test for accuracy, and correct the instruments from time to time. When referring to the Gas Referees, he says that, these gentlemen being Board of Trade officials, stamping by the Standards Department is unnecessary. Dr. Tichborne is appointed by the Board of Trade, and paid by the Gas Company, exactly as the Referees are, who are paid by the London Gas Companies. If these gentlemen, as Mr. Mayne says, being Board of Trade officials, consider it unnecessary to have the instruments stamped by the Standards Department, why should it be considered necessary in Dublin, where there is also a Board of Trade official?

As the correspondence had by this time, as Mr. Mayne put it in his last letter, "entered on the stage of contradiction that invariably crops up when any discussion on gas management takes place in Dublin," we shall leave the matters in dispute until some proceedings thereon are taken in the City Council.

PARÁ GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Wednesday, at the London Offices, No. 16, St. Helen's Place, E.C.—Mr. U. J. BURKE in the chair.

The SECRETARY (Mr. T. S. Borradaile) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts, to which reference was made in last week's issue.

The CHAIRMAN, in moving the adoption of the report and accounts, said he thought that, on the whole, the shareholders would agree with him, looking at what the Company had gone through in the past, that there was reason for congratulation on the present state of their affairs. As they would see, in comparing the working of the two past half years, there had been a considerable improvement both with regard to reduction in expenses and increase in revenue. The notable advance in the revenue had been on the residuals. There had been an increase in the sale both of coke and tar—he might say a very considerable increase, considering the amount with which they had to deal. There had also been an increase in the receipts for public lighting; but, he was sorry to say, there had been a slight diminution in those for private lighting. They did not find that the private lighting was expanding at the present time quite so fast as could be wished. But this was not surprising when they considered the state of Brazil in regard to the revolution that was going on; and, as to Pará, the consumers of gas hardly knew how they stood—they did not know, as long as the Government delayed their decision as to whether they would have this or that contract, whether they would have to buy gas, electric light, or oil. The Directors gathered from their Manager's letters that this was why people were now so shy of going in for more fittings, and embarking in gas consumption. On the other hand, looking at the expenditure side of the revenue account, there had been a considerable decrease in the expenditure on coal, and a large reduction in carbonizing wages, although they would not have been surprised if there had been an augmentation, because like other gas companies they had had to considerably raise their stokers' wages. There was a slight increase in repairs; but this was accounted for by the fact that the mains in the lower part of the town had been flooded. In the general charges, there had been a diminution, which looked exceedingly well. He might also mention that there had been a reduction in fines; and this was not only due to the clemency of the Camara, but also to the fact that the Company had been supplying a much better gas—practically 15-candle gas—which they had been enabled to do because the Government had paid their bills more punctually. He believed that on previous occasions the shareholders had been told that, if the Company had been in a better position by the Government paying their accounts regularly, a gas of higher quality would be supplied; and this was now being done. Speaking generally, without going into actual detail, he might say the Company's Auditor (Mr. P. Crellin) estimated that there was an improvement of practically £5000 upon their working as compared with the previous half year, and something rather less when compared with the corresponding period of 1892. Looking to the difficulties the Directors had experienced, owing to the strike of the miners in England (which had made it very difficult to send out coal punctually, besides adding to the expense); looking to the difficulty of the quarantine at Pará, which had been a serious matter for the Directors' consideration; and looking to the fighting that was going on in Brazil, he thought they had reason to congratulate themselves upon being in a position to pay a dividend, though a small one. He believed, in these troublous times, the shareholders would not have been surprised if the Directors had not been able to recommend one. So far he had been speaking of their working; but what would be perhaps more interesting to the shareholders was the question as to what was being done respecting the concession. The Directors had hitherto been in this position: They had been rather tongue-tied in reference to what they were doing in this matter, because they did not want to impart the history of their affairs to people on the other side. Now he thought they were in a position to tell the shareholders exactly how the Company stood. What they had been going through was this: As those present were aware, the contract under which the Company had been working expired in October, 1892. The Directors were then asked to continue the lighting for another year, which they did. This was to give the authorities at Pará time to make up their minds as to what they were going to do. Then the Directors were requested to continue the lighting for a further two years; but they said, in effect, "No; we are not quite in a position at the end of our contract to do this. Our plant has been working for some 30 years; and we are not now in a position to go on supplying gas from hand to mouth in this way. We should have to embark on additional outlay for mains, as well as other expenses; and it is hardly fair we should be asked to do this when we may be 'bowled out' in another year." Well, the Directors then offered to renew the contract for one more year if the Government would be responsible for the expenditure on mains, because some of the mains and other parts of the plant began to want renewing. The Government consented to this; and so the Board agreed to continue the lighting to October, 1894. Then came an advertisement for tenders; but the Directors were no more in a position to tender when this advertisement appeared than they were previously. However, what the Board did was this: They sent to the Government of Brazil a communication, in which they put their case somewhat in this way: "We are prepared to give you such-and-such a light, on such-and-such terms, subject to such-and-such restrictions, provided, if you think it is likely our tender will be accepted, our shareholders will agree to it when it has been accepted by you. We are not in a position to pledge our shareholders before they have agreed to these terms, and until we know that such a tender as we have framed will be accepted by you." The Directors felt that nobody could know better than they—having worked this concern for something like 30 years—what they could afford to give. They thought it would be idle to submit a tender which they were convinced they would never be able to work with the hope of any profitable return. The Directors took a business-like view of the matter. They said: "We can give gas of such a quality; and we must be paid at such a rate. Beyond this we cannot go." It was quite possible, however, that a more speculative company might come to the front, and put forward a tender which would prove more acceptable. The Directors waited a long time to see what would happen; and eventually they received a telegram from their Manager to say that an electric light tender by the Bond or Tramway Company had been accepted. This, however, did not frighten him (the Chairman), because a great deal had been heard of the wonderful things that electric lighting was going to do in England, where it had a much better chance of getting on than it would have in Pará. But in any case, what the Electric Light Company would have to do would be to obtain their capital (this they would find an exceedingly difficult matter in Pará), and get their works ready for the lighting by October next. He left the shareholders to judge how far this was possible. The position, then, was this: The Gas Company were under contract to carry on the lighting until October next; and then, up to the present, the Government had nothing else to lean upon but the Electric Light Company. The Gas Company had been under contract with the Government for 30 years; and the Directors were very loath to press their position at all, and put them in a hole. But still they could not pledge the shareholders to go on supplying fresh capital for the purpose of working from hand to mouth. They therefore thought it was the best plan to address a letter to the President, and show him exactly how the case stood. "You must understand," the Directors said, "that the contract will come to an end in October, 1894, unless fresh steps are taken; and you must see that, on the expiration of that contract, the town may possibly be in darkness. We cannot supply more capital to go on with, because we can hardly expect the shareholders to supply capital for another year; and consequently if you wish the Gas Company to go on helping you over the stile, you must be responsible for the capital." The letter of which this was the pith had only just been forwarded; and what the result would be, he (the Chairman) did not know. Perhaps the Government would help the Company with capital, or they might accept the proposal which had been submitted by the Directors; but, of course, this was, to a certain extent, handicapped by the fact that an electric lighting tender had been accepted. As he had said, personally the electric light did not frighten him. He did not think it likely it would become a general light in Pará, though he believed it was exceedingly probable that for a year or two it would be puffed; but in the long-run, when they came to put up overhead wires (which were found so objectionable in other parts of America), he did not think they would be able to carry on the public lighting better than the Gas Company had done. This was exactly how matters stood at present; and as soon as the Directors received an intimation as to what the Government proposed to do, they would put the shareholders in possession of the information. Of course, if the contract was accepted, then it would be necessary to call the shareholders together to ask whether they would accept the suggested terms. There was no doubt, however, they must have some more capital; and as far as he could see, the Company would have to be reformed and the capital revoted. As he had already remarked, it would be idle to put forward a speculative form of tender; and that position had been rather accentuated by the coal strike here and the quarantine regulations in Brazil. They could not keep a year's supply of coal out there; and the quarantine had become a very serious thing—indeed, at one time their Manager was doubtful as to whether they would be able to get coal to Pará at all. The Directors had had to charter a steamer to carry out 2000 tons; but that was an exceedingly expensive way of sending out coals.

Captain J. WALROND CLARKE seconded the motion.

Mr. CUFF thought that the shareholders must feel satisfied, under the circumstances, with the improved report on this occasion. It seemed to him the authorities were treating the Company a little more leniently in the matter of fines. He did not know whether the Directors ascribed this to any extent to their hope that it would enable the Company to put in a more favourable tender than they would otherwise do. He trusted it would not influence the Board in that way; and he urged them to secure the Company, as far as they could, against the unjust treatment they had met with in the past.

The CHAIRMAN said he was afraid there might be a great deal in Mr. Cuff's suggestion, though he did not like to say so actually. But he thought the way the Company had been treated recently was not perhaps entirely without an eye to the fact that they were tendering. With regard to the fines, the Board had been greatly exercised as to how they could avoid them. What he (the Chairman) had proposed was that they should not be under the power of being fined on the mere *ipse dixit* of an officer of the Camara, who was thereby benefited, but that there should be some automatic check on the lighting—such as the average meter system, as was in vogue in London. However, the conditions out in Pará were so dissimilar to those in London, as to induce their Manager to look with anything but favour on that system. Replying to a further question, he stated that, in arranging to continue

the lighting for another year, the Directors insisted upon being exempt from fines to a certain extent.

The motion was then carried.

Resolutions were next passed, declaring dividends at the rates of 7 per cent. per annum, less income-tax, on the £5 per share called up on the preference shares, and 2 per cent. on the ordinary shares.

On the motion of Mr. DODGSON, seconded by Mr. SELLS, the retiring Directors (Mr. T. Rumball and Captain Clarke) were re-elected; and on the proposition of Mr. CUFF, seconded by Mr. GODWIN, the Auditor (Mr. P. Crellin) was reappointed.

Mr. CRELLIN, in thanking the shareholders, said he thought the extension of the Company's pier (or *ponte* as it was called) and other changes which had been effected would lead to even a better result in the profits during the current half year than in the past six months.

The CHAIRMAN said that was a point he had overlooked. Hitherto they had had great difficulty in getting large vessels unloaded, because of the wash at the end of the *ponte;* and so the Directors thought it would be better to extend the pier and erect a new crane. This had been carried out at an expenditure of £600; and their Manager estimated that the Company had already nearly saved that amount. The Chairman took this opportunity of remarking that their Manager (Mr. J. R. Hislop) had fully justified the confidence of the Board in him.

The services of the Chairman and Directors, the Secretary, and the Manager were acknowledged; and this concluded the proceedings.

THE ELECTRIC LIGHTING QUESTION IN LONDONDERRY.

The Lighting Committee of the Londonderry Corporation met last Tuesday, under the presidency of Mr. T. S. Magee, to consider the present position of the electric lighting scheme, and the desirability of asking the Local Government Board to make a further advance of £5000, to enable the Committee to completely light the city with arc lamps. The following statement of the financial position of the undertaking appeared in one of the local papers on the following day: The present contract is for 160 lamps; and it is estimated that about 60 more—making a total of 220—will be required. The running power of the machinery is 240 arc lamps; and there are a spare engine, boiler, and pair of dynamos to run 160 more in case the city so extends as to render this necessary. In the meantime, they are merely kept in the station as a stand-by in case of accident to the other plant. The accepted tenders for buildings, boilers, engines, and the entire electrical plant amounts to £14,193; and the extra expenditure on these, as far as ascertained, amounts to a sum of £300 only. The cost of the site of the generating station is £600; and the law costs exceed £500. The engineers' fees will amount to nearly £900. The cost of opening and closing the streets for laying the cables totals up to £503 10s. 8d. The payment for royalty on the lamp-pillars made locally was £100, and £75 for 10 additional pillars. The Clerk of Works costs £75; and other items of the account represent a sum of about £400. The expenditure and liabilities of the Corporation up to this date are represented by the total of the foregoing—about £17,000; and the difference between this sum and £20,000 will be required in case the additional lamps are erected. The annual working expenses of the station will be: Electrician in charge, £200 per annum; engine-driver, £80; stoker, £52; dynamo attendant, £52; and two lampmen (at 18s. each), £93 12s. The coals will cost about £500; and oil, waste, and carbons for lamps, £429—making a total of about £1400 per annum. The Corporation pay the Gas Company £2500 per annum. The difference between these two annual sums will pay off the Government loan, and make ample provision for depreciation, renewals, and repairs.

As the foregoing figures were put forward with some authority—being contained in what was published as an "official report" of the Committee's meeting—we shall not presume to criticize them, especially as this has been very well done by the *Londonderry Sentinel*. A few extracts from a leading article in that paper will here be interesting. The *Sentinel* first of all characterizes the report as a "document full of misstatements intended to hoodwink the citizens and conceal the existing alarming state of affairs." The writer then proceeds to justify this assertion as follows: "The report, in the first place, omits to mention that the Chairman was forced to admit that the lighting of 160 lamps will cost £17,500, irrespective of extras and other necessary expenditure, which will bring the amount up to over £18,000. Yet before his re-election, he told the electors of the South Ward on the 18th of November last, that the cost of 160 lamps would he £15,793. This, no doubt, was merely an electioneering statement; but no clever candidate should commit himself to a statement that can be falsified with two short months. The report further states that 'it is estimated that about sixty' lamps will be needed in addition to the 160. Now, if 160 lamps have cost over £18,000, it is evident that 60 more will cost considerably more. They cannot cost much less than £2820. Thus nearly £21,000 is accounted for, even if 'about sixty' really means 'only sixty,' which is very questionable, judging by the experience of the past in connection with the scheme." The next matter dealt with is the statement in the report in regard to the opening and closing of the streets. Instead of being £508, the writer says this item should be within a few pounds of £620. He then goes on to show that there are other misrepresentations in the report. The producer of that document, in a desperate attempt to prove that the light will not be introduced at a loss of £1000 or £1500 a year, after lowering the annual cost for maintenance of electricity and raising the annual charge of the Gas Company, makes the assertion that the difference between £1400 and £2500—viz, £1100—will "pay off the Government loan, and make ample provision for depreciation, renewals, and repairs." The *Sentinel* writer says on this matter: "Of all the statements that have been hurled at the heads of the citizens, this is perhaps the most astounding. It is not only based on wrong premises, but is absolutely wrong in itself. It is based on the assumption that the Gas Company charge the Corporation £2500 for the lamps which will be extinguished when the new illuminant gives forth its first spark; whereas the Company, cording to the last annual statement of the Corporation accounts, only charge the Corporation £2145 12s. 10d.—a difference of over £300 a year." This reduces the margin of £1100 to £745; and the writer points out that this is insufficient by about £130 to repay the loan of £15,000. Where, then, he very naturally asks, is the "ample provision for renewals and repairs." The repayment of the loan of £15,000 averages £873; but as another £5000 at least will have to be borrowed, the amount must be one-third more, or £1164. So that, according to the "official report," there will be only £745 available out of which to pay £1164; and even then nothing will be available for depreciation, which should be put down at (at least) £1000 a year. This is accepting as correct the Lighting Committee's own estimate of the annual cost of maintenance; but as other estimates have not been altogether accurate, it may be the same with regard to this one. Summing up the matter, the *Sentinel* says: "It seems to us that 220 lamps will cost the city at least £20,000; that the average repayments on £20,000 will be £1164 a year for 25 years, and to meet this the Committee will only have £745; and they will, in addition, require to allow at least £1000 a year for depreciation. The working expenses will be £1400. Thus the loan, working expenses, and depreciation allowance will reach £3664, or £1500 more than the lighting of the city by gas costs. Councillor Magee on Oct. 11, 1892, promised a margin of profit of £200 a year on an expenditure of £15,000. His organ echoed that promise. Councillor Magee, on Nov. 18, 1893, judiciously dropped reference to the profit, but promised a 'beautiful electric light' 'without asking the ratepayers to contribute a single penny.' The Chairman is a greater financial genius than we take him to be if he can show how the citizens are to pay £1500 a year more for electric light than gas without 'contributing a single penny.'"

The Belper Water Company and the Local Board.—In consequence of the scarcity of water to many parts of the town, the Belper Local Board recently determined to open negotiations with the Water Company for the purchase of their property. The Directors favoured the proposal, which, however, had to receive the approval of two-thirds of the holders of stock before any decision could be given. The shareholders have since held a meeting, and unanimously passed a resolution empowering the Directors to treat with the Local Board with a view to purchase.

Water Supply in the Preston Union.—An application was recently made to the Local Government Board for sanction to a loan of £10,000, proposed to be raised by the Rural Sanitary Authority of Preston, for works of water supply in the villages within its area. An inquiry into the matter was recently held by Major-General Crozier, one of the Board's Inspectors; and as the result the Board have advised the Authority to enter into an agreement with the Preston Corporation for an adequate supply of water for a fixed period. On receipt of the agreement, the Board intimate that they will be prepared to consider the application for the loan.

The Discharge of Gas Refuse into the Sewers at Dorking.—Several times of late a question regarding the discharge of refuse from the Gas Company's works into the sewers has been before the Dorking Local Board; and a Special Committee were instructed to consider the matter. They forwarded a portion of the refuse to Dr. Stevenson for analysis; and, having received his report, they recommended the Board last Tuesday to call upon the Company to forthwith take steps to prevent any gas or trade refuse whatever being discharged from the works into the sewer. On the request of the Clerk, it was decided to consider the subject in Committee.

Discoveries of Coal.—An important discovery of coal has lately been made on the Kinlet Estate, which adjoins the extensive Bewdley Forest; and there have been great rejoicings at Bridgnorth in honour of the event. A splendid seam of coal 24 feet deep has been found at a depth of 300 yards; and it is believed that there are very great possibilities in this coal-field, which must lead to important developments. The boring operations have been so far carried out that the first shaft has been constructed, and the mining machinery is about to be erected. It is confidently expected that the discovery which has been made will lead to the complete opening out of the extensive district in mining operations, as it is held by competent mining authorities that the coal-bed extends from the edge of the Bewdley Forest to the Clee Hills. A discovery of coal has also been made at Forest Row, Kent. A party of men, while engaged in sinking a well, came upon a thick seam of coal. This is the second discovery of the kind in the county—a similar seam having been struck in some brick-fields on the borders of Kent and Sussex. Samples of the fuel have been tested, it is stated with highly satisfactory results. A Committee has been formed for the purpose of prosecuting experiments.

The Recent Explosions in Electric Light Boxes.—A report on the recent explosions in boxes belonging to the City of London Electric Lighting Company on Ludgate Hill and in St. Paul's Churchyard, has been issued by Mr. W. H. Preece, whose attention, it may be remembered, was called to the matter by the Commissioners of Sewers. He states that the two explosions occurred simultaneously in a box in Creed Lane and in another nearly opposite the premises of Messrs. Howell in St. Paul's Churchyard—a distance of 55 yards apart. The effect of the explosion was to blow the covers of the boxes to a considerable height in the air. One of them broke in falling; while the other made a hole in the pavement, and stood upright in the aperture it made. One person (a boy) was injured. A careful examination of the boxes revealed the fact that the explosions were caused by an accumulation of coal gas and air in the pipes and boxes. The cables carrying both the public and private current were in good condition; and the electrical tests proved that there was no leakage on the circuit to cause the accident. At the time of the explosions, some of the Company's men were working at a distance of 50 yards away; and they were using a red-hot plug, or "rat." It was possible, Mr. Preece says, that this red-hot iron might have ignited the gaseous mixture. The City of London Electric Lighting Company have since introduced a system of inspection of boxes; and by extra vigilance on the part of the employees it is believed that immunity will be secured from such dangerous explosions in the future.

METROPOLIS WATER SUPPLY.

The Quality of the Water during December.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 182,927,690 gallons, as compared with 174,939,419 gallons in the corresponding month of 1892. The number of services being 800,565, the rate was 228 gallons to each service. Of the entire bulk of water sent out, 94,505,985 gallons were drawn from the Thames, and 88,421,705 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies was: Tottenham, 1·1; Kent, 1·4; Colne Valley and East London (deep well), 1·5; New River, 1·9; Chelsea, 2·8; West Middlesex and East London (river supply), 3; Lambeth, 3·1; and Southwark and Grand Junction, 3·2. The unfiltered river waters contained the following proportions: New River Cut, 1·5; East London intake, 4·3; and the Thames at Hampton, 3·8. The Thames at Hampton was turbid and yellow on the 7th of December; it was, however, chemically of fairly good, but bacterially of very inferior quality. Contrasted with the unfiltered water, the supplies of the five Companies drawing from the river showed considerable chemical, and the following percentage bacterial, improvement: Chelsea, 99·89; West Middlesex, 99·93; Southwark, (No. 1 filter, Battersea works) 97·15, (tap on main, Battersea works) 98·61, (No. 4 filter, Hampton works) 99·60; Grand Junction, (general filter well at Hampton, Dec. 25) 97·21, (ditto, Dec. 29) 99·49, (south well, Dec. 25) 99·56, (ditto, Dec. 29) 99·68; and Lambeth, 96·80. The water was in every case efficiently filtered before delivery. The unfiltered water, taken chiefly from the River Lea by the New River Company, was turbid and pale yellow on Dec. 8. It was chemically of very good, but bacterially of inferior quality. It was efficiently filtered before delivery, and was improved bacterially to the extent of 99·35 per cent. The crude river water of the Lea, at the East London Company's intake at Angel Road, was turbid and yellow. Both chemically and bacterially, it was of much worse quality than on Nov. 10. The intake was, however, closed at the time my sample was taken. It was efficiently filtered before delivery, and considerably improved in respect of chemical purity. Compared with the raw river water collected on the previous day, the number of bacteria per cubic centimetre was reduced to the extent of 99·21 per cent. The deep-well waters of the Kent, Colne Valley, Tottenham, and East London Companies were of excellent quality for dietetic purposes. They were clear and bright without filtration; and the Colne Valley Company's water was softened before delivery, and thus rendered suitable for washing. The Kent Company's deep-well at Plumstead yielded water of even a higher degree of organic purity than was the case in 1873, when I first examined it. The proportion of chlorine is now slightly less; but that of nitrogen as nitrates has considerably increased, though not to such an extent as to throw any suspicion upon the wholesomeness of the water. The bacterioscopic examination of this water is also satisfactory. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and East London (deep-well) waters were clear and colourless; the New River, clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters, and of those supplied by the various Companies, collected on the 7th, 8th, 11th, 25th, and 29th of December, gave the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw River Waters.		
Thames at Hampton	6,316	5·4
New River Cut	3,408	5·4
Lea at Angel Road	11,842	5·5
„ after storeage	1,369	5·5
River Supplies.		
Chelsea	7	5·3
West Middlesex	5	5·4
Southwark (Filter No. 1, Battersea works)	180	5·7
„ (tap on main „ „)	88	6·3
„ (Filter No. 4, Hampton works)	25	5·6
Grand Junction (general filter well, Hampton, Dec. 25)	176	6·3
„ „ (Ditto, Dec. 29)	32	6·2
„ „ (South well, Hampton, Dec. 25)	28	6·2
„ „ („ „ Dec. 29)	20	6·1
Lambeth	202	5·4
New River, main filter well	22	5·7
East London, No. 1 Essex well	94	5·5
Deep Well.		
Kent, Plumstead well	30	11·5

In the course of their report for the past month to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.), Messrs. Crookes and Odling say: "Of the 168 samples examined, all were found to be clear, bright, and well filtered. During the month of December, the changes in the chemical constituents of the Thames-supplied waters have been very slight. The decrease of temperature and the diminished amount of oxidation through the agency of plant growth have been followed by a minute, but wholly unimportant, increase in the organic carbon present, shown alike by the 'combustion,' the 'oxidation,' and the 'colour tint.' The increase, however, in each case is very small; the amount being, in fact, lower than it was in either of the months of December, January, February, or March last, although a trifle higher than in November. The following table shows how favourably the month just ended compares with the corresponding month of last year:—

	Nitric Acid.	Hardness in Degrees.	Oxygen required per Gallon.	Organic Carbon per Gallon.	Colour. Brown: Blue.
Dec., 1892	1·054	17·70	0·060	0·134	22·8 : 20
„ 1893	0·935	16·36	0·044	0·096	19·4 : 20

Note.—All the figures are means.

The singularly small rainfall which characterized most of the months of the year 1893 was continued to the end. The actual fall at Oxford during December was only 1·72 inches; whereas the mean rainfall for 25 years is 2·10 inches. The deficiency has therefore been 0·38 inch. With the exception of February and July, when the fall was decidedly above the average, and October, when the mean fall was only just exceeded, every month was conspicuously deficient in rain. The unusual character of the past year in this respect may, perhaps, be better appreciated if the rainfall is given in a tabular form, as set forth below:—

	Actual Fall.	Mean of 25 Years.	Deficiency.	Excess.
January	1·88	2·26	0·38	—
February	2·64	1·92	—	0·72
March	0·18	1·59	1·41	—
April	0·06	1·78	1·72	—
May	0·84	1·95	1·11	—
June	0·77	2·21	1·44	—
July	3·70	2·58	—	1·12
August	1·01	2·24	1·23	—
September	0·57	2·66	2·09	—
October	2·65	2·56	—	0·09
November	1·68	2·31	0·63	—
December	1·72	2·10	0·38	—
	17·70	26·16	10·39	1·93

It is thus seen that there is a deficiency over the whole year of no less than 8·46 inches of rain, or nearly one-third of the mean quantity falling on that part of the gathering-ground of the Thames Valley supplying the chief sources of the river."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have a very light budget of "Notes" this week, the reason for which I am at a loss to explain. Perhaps the most important item of information which I have been able to lay my hands upon is that a conference of representatives of County Councils was held in Edinburgh on Wednesday, at which the subject of amending the Local Government (Scotland) Act was discussed; and on the motion of Mr. Bine Renshaw, M.P., it was resolved to recommend that in the amending Act power should be given to County Councils to introduce compulsorily a water supply to populous places, and to form lighting and cleaning districts. The unanimous adoption of such a resolution, I take to indicate a rise in the aspirations of rural communities towards better conditions of living. When may we expect to have County Councils owning gas-works for the supply of light to populous places, as we have municipalities doing at present? The notion is not altogether a dream. Sanitation is now being pushed so far in rural districts, that many of the discomforts of residence beyond town boundaries—such as defective water supply and absence of cleansing—are disappearing. With their disappearance, and the introduction of better water supplies and cleansing, a more desirable class of residents may be expected to make their homes in districts which are now avoided by many; and the result will be a demand for light. There are many districts within the jurisdiction of County Councils where a gas supply might be provided with profit, but is not, because of the want of machinery for the bringing of it into existence. With power in the hands of County Councils to light the thoroughfares in certain districts, there will be ready to hand the means for instituting lighting arrangements; and therefore it is not by any means improbable that, before many years are over, we may have gas-works as well as water-works owned and managed by County Councils for the supply of suburban localities and populous districts further afield.

It is not, I suppose, generally known that the patent relating to the Young and Bell oil-gas process was only recently sealed. There was a good deal of delay, on account of proceedings before the officials in the Patent Office; but these are now all exhausted, and the invention is the absolute property of the Company who acquired it from the patentees. Licences to work the system may now be granted freely and unrestrictedly. I am told that the process is already in operation in fourteen places, two of which are in England; and that from every one the accounts which are received are that it gives no trouble in working, and that the results quite justify the representations of the inventors. There are, too, numerous inquiries regarding the terms upon which the Company grant their licences, literally from all parts of the world—from America, Australia, and the Cape—which, in one aspect, may be taken as a testimony to the wide circulation of the JOURNAL, for the process received its first, and has all along had its fullest treatment in your columns. It is quite in expectation that one of the large railway companies will shortly relinquish the manufacture of oil gas by the Pintsch process, and adopt the Peebles. The difference in the cost of oil will make it profitable for all railway companies to do so. For the Pintsch process, the oil which is suitable is said to cost about 7d. per gallon; whereas gas of equally high illuminating power can be made by the Peebles plant from oil at half that price. The Peebles gas, too, has the advantage in respect of the marketable nature of the residuals; and, further, being an absolutely permanent gas, it stands compression without depositing liquor. On this subject of condensation, I have made inquiry regarding the behaviour of the gas during the recent severe frost, which was by far the lowest temperature to which it has yet been subjected; and I have been informed that there was not a particle of condensation, which shows a very high standard of permanency. I understand that the experience which has been gained in the working of the process, has shown that an improvement may be effected in the plant—not entailing an alteration upon the process—which will enable it to be fitted up at less cost than the first ones erected. This will be good news for those who contemplate adopting the process; and on that point, I may say that an experimental plant is, I understand, being fitted up in one of the works of the South Metropolitan Gas Company, while another is likely to be erected at one of the stations of the Glasgow Corporation.

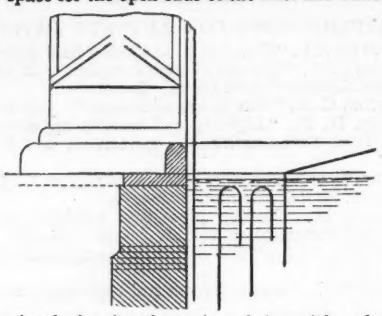
Two London gas engineers were in Falkirk yesterday in the interest of the Police Commissioners, who are in Parliament seeking powers to

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Gasholder Construction.

SIR,—In connection with the subject of the interesting article on gasholder cups in yesterday's JOURNAL, I should like to say that I have adopted what I believe to be a good plan in designing gasholders and tanks—viz., making the tank deeper than the outer lifts of the holder. The object of this is to cause the dips of the outer lifts to descend completely under water when they are down on the rest-stones. If they do not do so, then, as the inner lift descends, the gas blows out of the dip through the lowering of the water on the inside between the cup and dip. In fact, the cup carries its water down with it, and unseals the dip. I make the tank 6 inches deeper than the outer lifts; and I add 6 inches to the inner lift, to keep the top curb out of the water, and to allow space for the open ends of the inlet and outlet pipes.



I enclose a sketch showing the tank and three lifts of the new gasholder for the Bradford Road station of the Manchester Corporation in position when at rest. It will be seen that a stone curb is placed above the coping of the tank, and that the pier-stones on which the standards are erected are brought up to the level of the top of the curb. This allows of keeping the tank filled to the top edge of the flat coping. Of course, when the dips descend under the water, the water in the tank outside the dips flows over them, and replaces that carried down by the cups.

G. E. STEVENSON.

Rochdale Road Gas-Works, Manchester,
Jan. 24, 1894.

The Cost of Lighting the City of London.—An account of the estimated assets and liabilities of the Commissioners of Sewers of the City of London has just been published. The liabilities amount to £383,362. This sum included electric lighting, £18,332; and gas lighting and testing, £7500.

Accident at the Wallasey Gas-Works.—An accident of a shocking character occurred last Wednesday at Poulton, on the land now being utilized for the extension of the Wallasey Gas-Works, whereby a man named Walsh, in the employ of the contractors (Messrs. Marr and Son, of Liverpool), sustained very serious injury. It appears that Walsh was engaged removing soil from the site by means of bogie waggons and horses; and while in the act of uncoupling a loaded waggon when in motion, he slipped and fell, one of the wheels tearing off the flesh on the calf of the leg in a fearful manner. The Gas Engineer (Mr. H. Ashton Hill) happened to be on the spot, and rendered first aid. The injured man was then conveyed to the Birkenhead Borough Hospital.

The Barnsley Corporation and the Penistone Water-Works.—An explanation was made by Alderman Pigott, at last Tuesday's meeting of the Barnsley Town Council, with reference to the action of the Water Committee in declining to accept the offer of the Penistone Local Board to sell their water-works to them for £24,000, and in withdrawing the Bill which had been promoted in Parliament. He said the Committee regretted that the negotiations had resulted in a failure to carry out a scheme which at one time was thought would be advantageous to the town. In 1884, 1887, and 1893, when they were short of water, they looked to Penistone for a supply. When the negotiations to purchase were commenced, the Clerk to the Local Board (Mr. Hodgkinson) informed the Committee that they were willing to sell for a sum not less than £20,000 or more than £24,000, subject to certain agreements existing between the Local Board and the Penistone Rural Sanitary Authority, and the Darton Local Board. At the time, and at every subsequent interview, Mr. Hodgkinson conveyed no intimation that there was a clause enabling Darton to supply the neighbouring districts with water; and when this was discovered, it was pointed out to the Committee. Mr. Hodgkinson admitted that he had made a mistake, and expressed his regret, stating that he had acted in good faith, and had only recently discovered that such a licence existed. It was subsequently found that the Barnsley Rural Sanitary Authority had agreed to take water from Darton; and the Committee requested the Town Clerk to write to Penistone asking for some explanation of the difficult position in which they had put the Corporation. Mr. Hodgkinson replied admitting that the responsibility rested upon him, but that the existence of the licence was unknown to him until quite recently. Alluding to further negotiations, Alderman Pigott remarked that the Penistone Local Board sent the Committee a letter giving them a fortnight to consider the matter; but it was only received the day before the ultimatum was due. The Committee met on Dec. 30; and, after careful consideration, decided not to purchase, and therefore, as a matter of necessity, to withdraw their Bill. Under the circumstances, they felt this was the only course open to them. What they would do about the costs he did not know; but the least they could expect was that the Penistone Local Board should pay whatever expense had been incurred. A short discussion followed this statement, in the course of which remarks were made which indicated that the Council entirely exonerated the Committee from all blame.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Saturday, Jan. 27.

(Before Mr. Justice STIRLING.)

Re Hirschfeld's Patent (No. 2889 of 1893).

A petition having been presented by the Incandescent Gaslight Company, Limited, for the revocation of Herr Hirschfeld's patent for an incandescent light, the matter came before the Court for directions as to service and mode of trial.

Mr. MOULTON, Q.C. (with him Mr. TERRELL), who appeared for the applicants, said the patentee was a foreigner residing abroad, but he understood that a Company already formed in London, called the Deimel Light Company, had arranged to work the invention of Herr Hirschfeld. Upon them, the petition had been served; and the Company had stated that they intended to defend the action. There could be no doubt that the petition had come to the knowledge of the patentee; and, under these circumstances, he submitted that there had been sufficient service.

Mr. E. E. JENKINS appeared for the Deimel Company.

His LORDSHIP thought it would be better that notice should be sent to the patentee.

Mr. MOULTON said this should be done.

His LORDSHIP then directed that the petition should come before the Court as a witness action.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Thursday, Jan. 25.

(Before Justices MATHEW *and* COLLINS.)

Holme and King v. The Mayor, &c., of Stockport.

In this case, the plaintiffs, who are Contractors at Liverpool, had made a gasholder tank for the defendant Corporation; and being dissatisfied with the award of the Official Referee, to whom the action had been referred, they now asked that it might be sent back to him, or that judgment might be entered for them.

Mr. MULHOLLAND and Mr. P. MORRIS appeared for the plaintiffs; Mr. GULLY, Q.C., and Mr. BYRNE represented the defendants.

Mr. MULHOLLAND said the action was originally brought to recover the price of certain work done in connection with the erection of a gasholder tank for the Corporation of Stockport. The statement of claim only set out the contract price, which was several thousand pounds; and certain other claims were added. The Official Referee decided against the plaintiffs on their claim, and against the defendants on their counter-claim, which was for a small sum of £143; thus disposing of all the issues in the action. The way in which the claim arose was this: A large quantity of the work was excavation; and, according to the specification, the plaintiffs were entitled to leave on the gasworks all sand, gravel, and ballast excavated, and to have a place allotted to them by the defendants for the purpose. The defendants refused to permit them to deposit a large quantity of this sand, &c.; and, in consequence of this, they had to remove to tips some 12,000 cubic yards, at a cost of £760. The claim in respect of this had been wholly disallowed by the Official Referee. Having read the clause in the contract bearing upon this point, Counsel submitted that, the defendants having refused to allow the plaintiffs to deposit the sand and gravel on their premises, which was a breach of the contract, the latter were entitled to damages, which were to be measured by the expense to which they were put. The only answer to this in the statement of defence was that they did not refuse. But the Official Referee—to the surprise of everybody, he believed—found that this was an extra or addition to the contract which required a written order from the Engineer; and he disallowed it on this ground.

Justice MATHEW asked if any application was made to the Engineer when the difficulty arose.

Mr. MULHOLLAND said the Official Referee found, as a matter of fact, that the Engineer had refused to allow the deposit of this ballast.

Justice MATHEW inquired if this was not within his authority, under the contract.

Mr. MULHOLLAND submitted that there was no authority in him to break the contract; and that was what this really amounted to. The contract stated that the defendants were to find a place on their works upon which the stuff was to be placed. The clause respecting written orders referred to alterations, additions, or substitutions, which must be ordered in writing by the Engineer. It alluded to matters being done under the contract, but not to a breach of the contract.

Justice MATHEW asked if the Engineer required the plaintiff to take the stuff away.

Mr. MULHOLLAND said he did not; but he refused to allow them to deposit it on the ground, and therefore the only alternative was to take it away. It was just the same as if a person refused to take delivery of goods ordered. All the vendor could do was to sell them on the market at the best price. The plaintiffs did the only thing open to them—they carted it away, at a cost of several hundred pounds. They contended that the action of the Engineer constituted a breach of the contract, and that they were entitled to damages.

Justice COLLINS asked if it was the fact that the Engineer for the defendants would not allow them to leave it on the ground.

Mr. MULHOLLAND said it was. He read a portion of the judgment of the Official Referee on this point, in which he stated that, although Mr. Jacques, the Engineer, said at first that he did not refuse, his evidence was subject to the remark that he was not able to remember all the conversations that took place; and he thought there was sufficient proved on the other side to make it necessary for him to find that the Engineer did refuse to allow any more of this ballast and gravel to be deposited, and did not specify any other place at which it was to be put. Then he went on to say that refusing to allow it to remain was, to his mind, a varying of the contract; so that, if plaintiffs wished to recover the cost of removal, they must have the Engineer's written order.

Justice MATHEW remarked that a breach of the contract was not a variation or addition to it. Did the Engineer not tell the plaintiffs where to put it?

Mr. MULHOLLAND said he did not; he never said anything of the sort. The fact was, he appeared to have lost his temper, and told them they might take it where they liked.

Justice MATHEW asked if this was the principal point.

Mr. MULHOLLAND said he believed it was; and he thought it was a very short one. There were two others—or rather two items—which would take a great deal longer to explain; but there was only one point. This arose on paragraphs 10 and 11 of the statement of claim. About six months after the plaintiffs had constructed the dry well, a leakage was discovered, which arose from a cause for which the plaintiffs were not at all responsible. They were required to do a lot of extra work; and for this they sought to be paid. The history of the matter was this: The whole work was, of course, constructed according to the most elaborate plans; and it was concluded in May, 1890. There was some dispute as to the exact date; but no one could bring it down later than October. There was the usual clause as to twelve months' maintenance. The Engineer had not given his certificate that the work was "completed to his entire satisfaction." But the Corporation took possession, and proceeded with the erection of the gasholder in May; and, of course, for twelve months afterwards, the Contractors were liable to make good any defects. During that year a leakage took place from the main tank into the dry well; and the plaintiffs' attention was called to it. They said there was no defective work whatever. The Engineer said he thought the puddle was wrongly put in; and he made them take it out, and put it in again. This was done; and there was nothing whatever the matter with the puddle in any shape or form. They then tried various experiments, at the direction of the Engineer; and finally the leakage was only stopped by the application of cement to the interior of the dry well—a thing which had never been specified for, but was entirely new. The plaintiffs asked for the cost of doing this; and they submitted that it was for the Official Referee to say whether there was any defect in the Contractors' work, or whether it was not a default in the original plan of construction. A number of scientific gentlemen were examined on each side.

Justice MATHEW asked if the Engineer had decided this point against the Contractors.

Mr. MULHOLLAND said the Engineer had decided nothing at all; there was a change of Engineers during the proceedings. He said he did not know what was the matter; but he suspected some foreign substance had got into the puddle, and prevented it from adhering. But this was all taken out; and it was proved that there was nothing wrong with it. He then directed them to try something else. The view the Official Referee had taken on this point was this: You guarantee to give them a water-tight tank. It does not concern me what was the matter with this tank, or where the defect was. You did not give them what you contracted to do; and therefore I will not relieve you in any shape or form. He submitted that there was nothing of this sort in the contract; they only agreed to construct the works according to the plans and specifications.

Justice MATHEW said if there was no defect in the Contractors' work, it was not maintenance. That clause only applied to defective work *in situ*. Had the Engineer given his certificate?

Mr. MULHOLLAND said, curiously enough, he never gave the final certificate at all. In point of fact, the defendants dispensed with it by taking possession of the works, and erecting the gasholder.

Friday, Jan. 26.

Mr. MULHOLLAND, continuing his remarks, said there was no finding by the Official Referee that the Contractors' work was in any way defective. A year and a half after the work was finished, the plaintiffs had, at the request of the Engineer, rendered the dry well with cement, at an expense of £144 18s.; and for this sum they were now suing. As the work proceeded, it was from time to time inspected by the Clerk of the Works, and no fault was found with it.

Mr. GULLY submitted that there was no contract by the defendants to point out a place where the sand or gravel should be placed.

Justice COLLINS asked if the Referee had not found, as a fact, that the defendants refused to allow the plaintiffs to put the sand and gravel anywhere on the works.

Mr. GULLY said the Referee had found that there was evidence on the plaintiffs' part of a demand that a place should be pointed out. It was a significant fact that the plaintiffs had never, during the construction of the work, made any complaint whatever that they had to carry away the sand and gravel. The 21st clause of the contract provided that the whole of the rubbish and earth not required was to be carried off the premises, and that all the ballast, sand, and gravel excavated and left over and above that required for the execution of the work was to be left on the ground in such places as the Engineer might direct. This was a clause entirely in favour of the Corporation, and one which they could waive. It was valuable stuff; and the Corporation could either retain it or not as they liked. The plaintiffs' claim for damages arose from the fact that the tip which they happened to get was a long way off the ground; but that could not be taken into consideration, as the contract ought not to be construed by the light of subsequent facts.

Justice MATHEW observed that the terms of the contract were very stringent, because it said that all over and above what was required for the construction of the works, was to be left.

Mr. GULLY submitted that the defendants were not contracting to take it if they did not want it.

Justice MATHEW said the Official Referee had not taken that line; he said that the Contractors could not recover unless they produced a written order for what they had done. If the plaintiffs were right in their construction of the contract, they ought to have left the ballast on the ground.

Mr. GULLY said, as to the dry well, it was essential that it should always be dry, in order to facilitate the inspection of the pipes at the bottom.

Justice MATHEW asked if the contract was not to supply a tank and dry well lined with puddle.

Mr. GULLY said he did not dispute that cement was not provided for in the original specification, though it was not correct to say that the Engineer had ordered it. It was merely put in as the result of various conversations which had occurred between the Contractors' Manager and the Engineer. By the contract the Contractors had guaranteed they would make a tank which would be effective for a year at least.

Justice MATHEW observed that the Contractors did not guarantee the effectiveness of the design.

Mr. GULLY, in conclusion, contended that the fact that the water came into the dry well after it was constructed, and that after the plaintiffs had (at the suggestion of the Engineer) re-puddled round it the quantity of water became diminished, showed that it was imperfectly puddled at first.

Mr. MULHOLLAND then briefly replied on behalf of the appellants.

Justice MATHEW, in giving judgment, said he was unable to arrive at the same conclusion as that to which the Official Referee had come—viz., that in order for the plaintiffs to recover the amount they claimed in respect of removing the sand and gravel, it was necessary to prove a written order by the Engineer for the work to be carried out. The interpretation put upon the contract by the Official Referee, as to the disposal of the sand and gravel, was clearly wrong; and on this part of the case, the amount in dispute not being agreed between the parties, the matter must be sent back to him. As to the cement which had been put on the inside of the dry well to keep out the water, that was supplied after the work had passed out of the plaintiffs' hands. In support of their contention on this part of the case, the defendants relied upon clause 9 of the contract, which stipulated that the Contractors should make good any imperfect or unsound work. The contract specified the description of puddling that should have been employed between the tank and the dry well. It was discovered, after the well had been completed, that there was a leakage of water into it from the tank. According to the evidence, the Engineer in the first instance thought that this leakage was due to some defect in the puddle; but it was clear that the Engineer was wrong in that respect. He directed the puddle to be removed and relaid; but after this had been done, the leakage continued as before, though not at the same rate. The result was that the well became filled up; and it became necessary to consider what ought to be done. The Engineer subsequently came to the conclusion that puddle was not the right thing to use; and he directed that a lining of cement should be put in the well. It had been said that this came within clause 9; but it was obvious that it did not. Then it was sought by the defendants to bring the cement within clause 25, which provided that the Contractors should be responsible for the soundness and stability of the work for twelve months after completion; and if any portion gave way, the Contractors should, at their own expense, make good, repair, and reinstate the same. It was argued by Mr. Gully that, under that contract, the Contractors were to supply a water-tight well; and in this view the Official Referee coincided. But he (his Lordship) was of opinion that they were both wrong. The Engineer, in ordering the cement to be put on the side of the well, was not ordering the Contractors to reinstate anything; he was really ordering fresh work to be done. Under these circumstances, the Contractors had a cause of action. But as it appeared the figures in respect of this head of claim had been agreed, it would not be necessary to send the matter back to the Official Referee on this point. As to the question of penalties counter-claimed for by the Corporation, as they very properly, did not press that claim before the Official Referee, he was of opinion that they ought to be bound by it.

Justice COLLINS delivered judgment to the same effect.

Friday, Jan. 26.

(*Before the* LORD CHIEF JUSTICE *and Mr. Justice* DAY.)

Improved Industrial Dwellings Company, Limited, v. East London Water-Works Company.

The Supply of Water at the East-End during the Late Drought.

This was an appeal on a special case from Mr. Rose, the Magistrate at the Thames Police Court, who had dismissed a summons, taken out against the defendants, seeking to inflict penalties upon them for not supplying water to the inhabitants of Morrison Buildings South in August last, according to the provisions of the Water-Works Clauses Act, 1847. But this Act exempts water companies from penalties in case the default arises from "unusual drought or other unavoidable cause or accident;" and the Magistrate held that such was the case here. The previous proceedings were reported in the JOURNAL for Sept. 12 last (p. 492).

Mr. FINLAY, Q.C., and Mr. NEWSON appeared for the appellants; Sir R. E. WEBSTER, Q.C., M.P., and Mr. BRAY represented the respondents.

The special case, setting out all the facts and the sections of the Act relied upon, having been read, as well as the Magistrate's judgment,

Mr. FINLAY submitted that the decision was not brought within the exception, because, though the Magistrate found that there was a deficient supply on the days named in the summons, he said it was, in his opinion, due to the "unusual drought, or to the extraordinary consumption of water in the district." He (Mr. Finlay) contended that this was an alternative finding, and that the second alternative was not within the exception.

The LORD CHIEF JUSTICE suggested that the "or" might be read "and;" and that, in any case, the *causa causans* of the extraordinary consumption wa sthe drought. One must use a little common sense in these matters.

Mr. FINLAY said it came to this—that, whenever there was unusually hot weather, and the public really required more water, the Company were to be relieved o ftheir obligation to supply it.

The LORD CHIEF JUSTICE said whenever a similar year to 1893 recurred they would have to consider it.

Mr. FINLAY having shortly urged the same point further,

The LORD CHIEF JUSTICE, without calling upon Counsel for the respondents, gave judgment. He said it appeared to him that the

Magistrate had decided quite rightly, and that his judgment was a very sensible one. It was a matter of common knowledge that last year was an unusually dry one; and, besides, it was for a great length of time an unusually hot year. The two things together produced a scarcity of water. The drought was caused by the hot weather; and, in consequence of the hot weather, people wanted to drink more water. Without the drought, this desire would not have arisen in the way it did. The Magistrate further found that the Company had done all in their power to meet the case, that they could not succeed because of the unusual drought, and that the deficiency of water was occasioned by causes over which they had no control; and he therefore dismissed the summons. He was quite right; and the appeal from his decision must be dismissed.

Justice DAY concurred.

Sir R. E. WEBSTER said he did not know whether it was necessary to ask for the costs; but he submitted that he was entitled to them.

The LORD CHIEF JUSTICE said "Yes." He added that he did not wish to say anything at all hard, but it struck him that this was a slightly vexatious attack on the Company.

The Queen v. Barber.—The Public Lighting of Eckington.

Application was made to their Lordships to-day to make absolute a rule *nisi*, granted on the 11th ult. (see JOURNAL for Dec. 19, p. 1131), for a *quo warranto* calling upon Frederick Barber to show by what authority he claims to exercise the office of Lighting Inspector under the Watching and Lighting Act, 1833, in respect to the part of the parish of Eckington, in the county of Derby, which is situate within 200 yards of the centre of the several streets, roads, or thoroughfares wherein gas-mains had been laid on Oct. 5, 1893, and also the main thoroughfare leading from Eckington, through Renishaw, to the boundary of the parish, on the following grounds: (1) That the Chairman of the meeting, held at 7 p.m. on Oct. 5, 1893, was not elected by the ratepayers present at such meeting. (2) That the said Chairman was disqualified from acting by reason of his interest as Chairman of the Eckington Gas Company. (3) That persons other than ratepayers were present at the meeting. (4) That the requisition to convene the first meeting on the above-named date was bad, as purporting to be made by ratepayers of the parish generally, and not by the village only. (5) That the right to convene the second meeting was bad, as purporting to be made by ratepayers of the parish generally, and not of the part affected; and that such requisition was, in fact, signed by ratepayers of that portion of the parish where the Act was already in force. (6) That, the second meeting not being a meeting of parishioners duly convened, the resolutions adopted thereat were invalid. It appeared that the meeting in question adopted the Watching and Lighting Act, and proceeded to erect lamps; but it was said that the only persons who benefited by them were persons who wished to go to Eckington from the Midland Station, whereas most of the people wanted to go from the station in the direction of Sheffield and Chesterfield. It was alleged that the meeting in question was called for the purpose of enabling the Eckington ratepayers to override the wishes of the ratepayers of Renishaw; and the result had shown that it was the interests of Eckington which were considered. It was under these representations that the rule *nisi* was obtained.

No Counsel being present to represent Mr. Barber,

Mr. GLENN asked that the rule might now be made absolute.

The application was granted.

Charge of Stealing from a "Penny-in-the-Slot" Gas-Meter.—At the Southwark Police Court last Thursday, James Maloney, 17, and Ernest Sales, 17, were charged with breaking open the receiver of a gas-meter at the Joseph Working Boys' Club, Camberwell, and stealing about 10s., in bronze money, belonging to the South Metropolitan Gas Company. The accused are members of the club, which is supplied through a prepayment gas-meter. Last Wednesday it was found that the meter had been forced open, and the contents abstracted. Suspicion fell upon the prisoners, and they were arrested. They made no answer when charged; and Mr. Biron directed a remand.

The Delivery of Water at High Levels in London.—In view of the petitions lately received by the London County Council with regard to the limit of height to which the East London Water Company are bound to deliver water, the Water Committee, at the meeting of the Council last Tuesday, reported that they had passed a resolution to the effect that advantage should be taken of the promotion of any Bills by the London Water Companies, to procure the amendment of the existing provisions in this respect, and also of those now regulating their charges for high-service supply; and that they had forwarded the resolution to the Parliamentary Committee of the Council for their consideration in connection with the Bills now coming before Parliament.

The Frimley and Farnborough District Water Company.—The first ordinary meeting of this Company was held on the 20th inst. The Directors submitted a report which stated that the Royal Assent to the Company's Act was given on July 27 last. The Engineer (Mr. H. U. M'Kie) had since that date been engaged in preparing plans, specifications, &c., for the works; and the Directors had been in negotiation with Messrs. John Aird and Sons, who were willing to contract to carry out the works for a sum within the Engineer's original estimate of £21,780. The prospectus to be issued had been prepared with great care, and was now awaiting the final settlement of a few matters before it was sent out to the public. The total number of shares taken by the proprietors promoting the Company was 203 of £10 each, making £2030, of which £874 had been paid up on deposit and calls. The cost of obtaining the Act was £1447. In the course of the proceedings, the Chairman (Mr. A. C. Pain) mentioned that there were at present 19 shareholders, representing rather more than £7000 altogether. He further announced that it would not be necessary to issue more than about £20,000 of capital, in addition to the amount already placed, to carry out the works, which would not all be required at once, but only as the works proceeded. The report was adopted.

MISCELLANEOUS NEWS.

MANCHESTER HYDRAULIC POWER SUPPLY.

Manchester is extensively occupied with new schemes and undertakings. The greatest of these—the Ship Canal and the Thirlmere Water-Works—have made some stir in the world; but, important as they are, they do not represent the full measure of municipal activity in the city. We have already made some reference to the electric lighting installation, and to the extensions which are being carried out, or are in contemplation, at the various gas-works. There is, however, another scheme which has received little attention as yet, though in its way it is of considerable importance, and marks a distinct advance in municipal enterprise. This is the hydraulic power system, which is to be inaugurated this week, and the object of which is to supply motive power in the business parts of the city.

Long before the Corporation took the matter in hand, attempts were made by private companies to obtain parliamentary sanction to supply hydraulic power in Manchester. These were opposed by the Corporation—not only because they are the water-supply authority, but also because they wished to retain full control of the streets, and to prevent outside interference with them. Having caused the abandonment of these projects, the Water-Works Committee gave some consideration to the subject at the close of the last decade; and early in 1890, they came to the conclusion that it was desirable for the Corporation to supply water under pressure, and recommended an early application to Parliament for such powers as might be necessary. The Corporation endorsed the views of the Committee; and when the Manchester Corporation Bill of 1891 was deposited, it contained a clause dealing with the matter. This clause, as finally adopted, reads: "The power conferred upon the Corporation by section 96 of the Manchester Corporation Water-Works Act, 1847, to supply any person with water for other than domestic purposes, at such rent and upon such terms and conditions as shall be agreed upon between the Corporation and the persons desirous of having such supply of water, shall extend to the supply by the Corporation within the city, by agreement, of water under pressure, for the purpose of supplying motive power by hydraulic pressure for any purpose to which such power is applicable, and such supply shall be deemed a part of the water-works undertaking of the Corporation."

Provision was also made by the Act for a capital expenditure, under this section, of £100,000. Mr. Corbet Woodall, M.Inst.C.E., was early retained as Consulting Engineer; and the works, which are now fast approaching completion, have been carried out from his designs and under his superintendence. Having obtained the necessary powers, the Sub-Committee who had charge of the undertaking proceeded to purchase a site for the works. This they found in Gloucester Street, which is within convenient distance of the area proposed to be supplied. Some 4240 square yards of land are available for the purposes of the station; and, roughly speaking, two-thirds of this has been utilized for the first installation—the remainder being reserved for extensions.

For the purpose of the present supply, there have been erected an engine-house, boiler-house, offices, and workshop. The station adjoins the Rochdale Canal; and the arrangements are so designed that the coal supply can be handled with ease and facility. When the coal comes in the barges, it will be lifted by a 20-cwt. hydraulic crane, and tipped into the coal-store. By means of an elevator of the ordinary type, it will then be raised into a trough, and carried forward by an endless screw to the hoppers of the mechanical stokers. These operations will also be carried out by hydraulic power; duplicate motors being fixed in the boiler-house to drive the machinery. Five double-flued steel-boilers, of the Lancashire type, have been erected. These are each 7 ft. 6 in. in diameter, by 30 feet long, and are fitted, not only with the mechanical stokers already referred to, but with large economizers in the flues. Provision is made for the erection of six engines. Two of these are already completed; and two more will, it is expected, be built within the next month. The erection of others will be deferred until the need of them arises. The engines are of the three-cylinder vertical, triple-expansion, condensing type. The high-pressure cylinder is of 15 inches diameter; the intermediate, 24 inches; and the low, 36 inches—all by 2-feet stroke. The pump-plungers are 4¼ inches diameter by 2-feet stroke. When the four sets of engines are erected, they will be capable of delivering 230 gallons per minute, against a pressure of 1120 lbs. per square inch, with a steam-pressure of 120 lbs. to the square inch, when running at a piston speed not exceeding 240 per minute. There are two accumulators, each with rams of 1 ft. 6 in. diameter, and 23-feet stroke. In each case the wrought-iron weight-case is filled with 100 tons of glass furnace slag, in order to give the required pressure. The pressure which will be maintained in the mains will be at least 1000 lbs. to the square inch; while at Liverpool, where a similar service is maintained by a private Company, it is 850 lbs.

At Manchester, the water supply will be taken solely from the Corporation mains; and it will, therefore, be of exceptional purity. It is stored in three big tanks over the boiler-house. Every possible arrangement is made by the duplication of parts, so as to prevent any possible cessation of power. Even the engines are so designed that, if anything goes wrong with the valves, these can be disconnected, and the engines run as if they were of the ordinary high-pressure type. The working of the engines is, to a large extent, automatical. When the accumulators are raised to the top, they close the throttle-valves, and stop the engines; while directly the accumulators begin to fall, they open these valves, and the engines start immediately.

So far between seven and eight miles of mains have been laid in the principal streets in the centre of the city; and it is the intention to extend these, from time to time, as a paying demand is developed. The largest mains are 6 inches diameter; and they range downward to 1½ inches. They are all cast-iron pipes, tested to a pressure of 3000 lbs. per square inch; and they are united by spigot and faucit joints, with overflanges connected by two bolts—the joints being made tight with rings of guttapercha cord. All cylinders, rams, pipes, valves,

and other apparatus subjected to the pressure from the mains are also to be tested to 3000 lbs. per square inch.

It is intended to maintain a constant pressure, day and night, and on Sundays and other holidays. One of the requirements of the Corporation is that each consumer shall be considered bound one year, and subject to three months' notice to discontinue the supply. A charge of about 5s. per quarter will be made for the meters. The minimum charge is to be £2 per quarter for 4000 gallons or under; and 5s. will be charged for each 1000 gallons up to 30,000 gallons. A reduced scale then comes into operation: For 50,000 gallons, the price will be £12 10s.; for 100,000 gallons, £20; for 125,000 gallons, £22 16s. 3d.; for 150,000 gallons, £25 12s. 6d.; and so on to 300,000 gallons, for which the Corporation will charge £42 10s.

The new works will make an encouraging start. About thirty machines were ready to be connected—including packing-presses, intensifiers, passenger lifts, goods lifts, and wall cranes. By means of the intensifiers, which embody a simple arrangement of differential rams, the initial pressure of 1000 lbs. can be trebled on the premises of the consumer. In Manchester, a considerable number of hydraulic presses are in use in the packing warehouses; and it is, of course, anticipated that the private installations will now give place to the public and more economical and efficient service. Arrangements have been made for the establishment of a show-room in connection with the offices. In this, there will be displayed various types of small motors and other appliances, with models of those which are too large to be thus exhibited. The Corporation are also erecting a passenger lift operated by hydraulic power; and as the offices are only two storeys high, this will be mainly for exhibition purposes also. Altogether the Water-Works Committee have gone into the matter thoroughly, and deserve credit for the manner in which they have carried out the undertaking. Much of this credit attaches in a special degree to Alderman Sir John Harwood, the Chairman, and to Mr. Alderman Leech, the Deputy-Chairman of the Committee. The latter especially has devoted much time to the scheme. The engines have been erected by the Hydraulic Power Company, Limited, of Chester; the boilers, by Messrs. Yates and Thom, of Blackburn; and the economizers, by Messrs. Green, of Wakefield. The buildings were erected by Messrs. W. Southern and Sons, of Salford.

THE GAS QUESTION IN DUBLIN.

A Newspaper Controversy.

The publication of Alderman Gill's defence of the Alliance and Dublin Consumers' Gas Company, of which an abstract appeared in the JOURNAL last week, has led, as might have been expected, to a newspaper controversy on the subject, some points in which call for notice.

Mr. Mayne, a former member of the City Council, was the first to take up the question; and his letter to the *Freeman's Journal*, defending the Corporation Gas Examiner, has been already given (*ante*, p. 160). In the course of his letter, Mr. Mayne, it may be remembered, complained that the photometer employed by the Company was one of the old Evans type, whereas that used by the Coporation Gas Examiner was one of the best and most modern that could be procured; and he asked Alderman Gill how he could expect testings made on two instruments so dissimilar to agree. To this letter Alderman Gill replied as follows: "The Gas Company are bound, by Act of Parliament and by the recent award, to use the Evans photometer, which is, and always has been, in the official testing-station. If the Corporation think otherwise, it has a simple remedy. It can take the necessary legal proceedings to compel the Gas Company to use instruments of the type mentioned by Mr. Mayne. For months past Mr. Thomas Cotton can have been using no other testing instruments except those so much praised by Mr. Mayne; as he has not tested in the new official testing-station since it was opened on the 1st of June last. How is it that, up to quite recently, he very seldom published tests less than 15 and some decimal candles, and often over 16 candles, while for some weeks past he has constantly published testings as low as 13 and even 12 candles? As a member of the Works Committee of the Gas Company, I know that exactly the same materials have been used in the manufacture of the gas for years past."

Mr. Mayne's letter was also replied to by Mr. W. F. Cotton, the Secretary and General Manager of the Gas Company, in the *Freeman's Journal* of the 20th, as follows:—

In the letter of Mr. Mayne, given in your issue of yesterday, the following erroneous statements appear in giving the results of an interview a deputation of the Gas Committee (of whom Mr. Mayne was one) had with Mr. Chaney, the chief officer of the Standards Department of the Board of Trade. "He asked what type of instrument the Gas Company had actually provided in the official testing-room, and when told it was an old Evans photometer having moveable candles, he said the Board of Trade could not verify, or recognize in any way, instruments of that type; that they were 'obsolete and unreliable;' and that two competent gas examiners testing the same gas with old instruments of that type might easily get a difference of one or two candles in their returns. I was a member of this deputation, and was astonished at these statements made by so high an authority."

On reading the above statement, I concluded that he was either labouring under a delusion, or must have misunderstood Mr. Chaney, which seems hardly possible, as the interview only took place in September last. Feeling that no man possessed of any practical knowledge of the Evans, or any other type of photometer, would make such a statement, I immediately communicated with that officer—giving a full copy of the above paragraph; and he replied that he "never made the statement as contained in telegram to anyone, and it is totally incorrect." It is also totally incorrect to say that "Mr. Chaney asked what type of instrument the Gas Company had actually provided in the official testing-room," considering that not many days previously he had been informed of the exact type of photometer. How will Mr. Mayne reconcile the fact that this same instrument—the Evans photometer—that was in use in the old testing-station for years before the Arbitrators (one of whom represented the Corporation) visited that station in 1889 to examine the instruments, which were condemned previously by the Inspector of Public Lighting a few months after that officer was appointed in 1888, is the same type of instrument which has been clearly and distinctly decided upon by the Arbitrators as the one complying with the Company's statutory obligations; and therefore they stipulated in the award that this type of instrument should be used in the new testing-station? Mr. Mayne will not venture to assert that, at the date when the instruments were condemned by the Inspector of Public Lighting, after his few months in office, that officer had any practical experience of photometers or photometry.

Intentionally, or otherwise, Mr. Mayne's letter conveys the impression that the tests made in presence of the Sub-Committee of the Paving and Lighting Committee, commented upon by Alderman Gill, were made on the Evans photometer with moveable candles; and in this way he tries to account for the discrepancy which occurred on that occasion between the two officers. Such, however, was not the case. The experiments were made on the Letheby photometer, in the old testing-station, with stationary candles; Dr. Tichborne making the first test, the Inspector of Public Lighting following with his on the conclusion of Dr. Tichborne. I maintain that whether the tests conducted in presence of the Committee were made on the Evans photometer, with moveable or stationary candles, or on the Letheby photometer, the discrepancy of close upon 2 candles could not occur within a few minutes had the tests been properly carried out by both officers.

It is hard to understand what Mr. Mayne means by inferring that the instruments are "obsolete and unreliable." How can they be obsolete so long as the Act of Parliament under which they are constructed remains in force? And as to their being unreliable, this could only be the case when the instruments are not carefully constructed, and the appliances not properly adjusted.

Mr. Mayne states that none of the Committee had ever seen gas tested before. They were "not even amateurs in the art or science of gas testing; and, further, knew nothing whatever of the elaborate calculations that have to be made after the testing is apparently over." Mr. Mayne's statement may be perfectly true; but it is quite evident he is in a similar position himself when he speaks of "elaborate calculations," as the necessary calculations only take from a minute to a minute and a half.

I think I am right in stating that Mr. Mayne has been an active member of the Gas Committee. Under these circumstances, it is hard to understand his anxiety to have the Company's instruments stamped, seeing that he must be aware that of the 23 photometers used in London, under the authority of the Gas Referees, who are the highest authority in the kingdom, not one of the photometers has been stamped, and that very few of them are of the same type. I may also mention that neither have the photometers in use in Manchester, Birmingham, Nottingham, Liverpool, Belfast, Londonderry, and the majority of towns been stamped—the stamping being looked upon as valueless.

The following is Mr. Mayne's reply to Alderman Gill's letter given above:—

Alderman Gill, in his letter, conveys, I am sure unintentionally, a very erroneous reading of the Gas-Works Clauses Act, 1871, and of the award which compelled his Company to erect the new testing-station in Tara Street. He says these authorities compel the Company to "use the Evans photometer, which is, and always has been, in the official testing-station." Neither the Act of 1871 nor the award compels anything of the kind. All Acts regulating the testing of gas, including the Act of 1871, as well as the award, provide for a proper and reliable test, on instruments which were the best of their kind at the time the Acts mentioned were passed. In none of them is there any sanction or mention of the instrument "which is, and always has been, in use in the official testing-station" in Dublin. The Gas Company's own Act of 1866 binds the Company to provide "proper and sufficient" apparatus for the testing of their gas at the official station; and that section of their Act has not been repealed or lessened in force in any way by the Act of 1871. No person knowing anything of photometric apparatus could contend for a moment that an old Evans instrument, having moveable candles and other defects, is a "proper" or "sufficient" means of testing for illuminating power.

Surely, if gas is to be tested at all, the test ought to be an accurate one, or at least as accurate as possible; and when instruments can be obtained, the accuracy of which would be certified by the Standards Department of the Board of Trade, the highest authority in the Empire, does it not occur to Alderman Gill that it is almost a contemptible position for him to be forced into occupying—that of defending before the public the use of an antiquated instrument, on which an accurate test is impossible, except by chance? Alderman Gill makes the position worse by inviting the Corporation to take legal proceedings against his Company to compel them "to use instruments of the type mentioned by Mr. Mayne." The type of instrument I have mentioned is any type that the Standards Department will certify and stamp; and let me put before Alderman Gill how this proposition of his must appear before the public. He and his brother Directors are engaged in the sale of an article the value of which depends on its quality. The duty of testing the quality of this article is thrown on the Corporation, who must appoint a gas examiner to perform this duty at an official testing-station, to be provided by Alderman Gill's Company. This officer complained of the unreliability of the means provided by him and his brother Directors for the performance of this work; and the Corporation ask them to submit those means to the examination of the authority provided by the State for such purpose. One would expect, from what we know of Alderman Gill and his brother Directors, that the moment a doubt was cast on the accuracy of the means they provided for testing the quality, and therefore the money value, of this article which they sell, he and they would be the first to put themselves right before the public by immediately submitting the instruments complained of to this high authority

for certification. Instead of doing so, Alderman Gill sneeringly invites the Corporation, who have no interest but that of performing their statutory duty in protecting the public, to take legal proceedings to compel him and his co-Directors to do that which they should have done voluntarily.

The most extraordinary circumstance, perhaps, in this correspondence is Alderman Gill's complaint, in his original statement, that the Corporation Examiner published different results from those obtained on the Gas Company's apparatus, while he now defends the retention and use of this condemned apparatus, which must perpetuate the differences he complained of.

At this stage of the controversy, a new figure—that of Professor C. R. C. Tichborne, LL.D., F.C.S., &c., the Board of Trade Gas Examiner—came upon the scene. The following letter from him appeared in the *Freeman's Journal* on the 22nd inst. :—

As far as possible, I do not wish to mix myself up with the contention now going on between Mr. Mayne and the Gas Company: but I think, as a neutral official, I should not be doing right if I neglected to point out a *via expedita* in determining the contention.

The present question in dispute seems to be the instruments upon which the tests are taken—that is to say, what are the instruments laid down by the Arbitrators appointed at the proceedings some few years ago. Everyone acquainted with these proceedings knows that all instruments used in Dublin must be of the kind specified in the award. The Gas Company say the instruments provided at the official testing-station do conform with the requirements as laid down by the Arbitrators. Mr. Mayne says they do not. Now, is it not very easy to determine this part of the subject if it is approached from a business point of view? Let two members of the Paving and Lighting Committee, two of the Gas Directors, myself, and the Inspector of Public Lighting, meet and examine these instruments in connection with the requirements of the award. I venture to think that we shall arrive at a conclusion in less than an hour. But assuming that we fail to come to an agreement, what is to prevent us having the instruments photographed, and the photographs forwarded, with exact measurements, to the Arbitrators, to answer the simple question: "Are these the instruments they selected?" I think this would be a better method than spending the money of the ratepayers in litigation.

In conclusion, I wish to add a word in connection with a personal matter. Mr. Mayne said (in speaking of the visit of the Paving and Lighting Committee to the testing-station): "They went ostensibly to see how the two Inspectors did their work, and to sit in judgment upon them." This is certainly very misleading, because, as the Paving and Lighting Committee will tell him, the meeting of myself and that Committee was purely accidental. They came in while I was testing; and I had no idea that I should see them, or they me. Lord Mayor Shanks asked me if I had any objection to explain the instruments: I did so, and took a test—describing the process as I went along. At the conclusion, as it was evident that they wanted to hold an investigation, I retired, returning later to finish my work. I was not present, therefore, and had nothing to do with the disagreeable scene which took place between Mr. T. J. Cotton and his Committee. I need hardly state that I should have been only too delighted to meet the Corporation Committee to clear up this and other points; but, on the occasion mentioned, it had not been so arranged. I had frequently asked the Gas Committee of the Corporation to do so; but they had always declined.

Next came letters from Alderman Gill and Mr. W. F. Cotton, in reply to Mr. Mayne's last letter. The former gentleman charged Mr. Mayne with inaccuracy in the statements contained in his last paragraph. "If," said Alderman Gill, "he read my last letter, even without very much care, he would see that my meaning, clearly expressed, was that Mr. Thomas Cotton has been using only the Corporation instruments (those so much praised by Mr. Mayne) since June 1, 1893; and that from that date up to some weeks ago, he seldom published testings less than 15 and some decimal candles, and often over 16 candles, while lately he has frequently published them as low as 13, and even 12 and some decimal candles—that is, he has made the testings, taken by the same instruments, chosen by the Corporation, vary as much as 4 candles from each other. I know that during all this time the same materials were used in making the gas. It was on account of this that I considered there was practically an accusation of fraud made against me and the other Directors of the Gas Company, as I said in the statement I published, which the Municipal Council refused me permission to make."

Mr. W. F. Cotton's letter was as follows :—

In Mr. Mayne's last letter, it appears, that he not only undertakes to pose as an authority upon gas apparatus and gas testing, but also as a correct exponent of the Acts of Parliament relating to gas. He states that "Alderman Gill conveys in his letter a very erroneous reading of the Gas-Works Clauses Act, 1871, and of the award of 1889, which compelled his Company to erect the new testing-station in Tara Street." Alderman Gill did not make the statement on his own authority. He has been well fortified with the opinions of most competent authorities on the subject. However, notwithstanding Mr. Mayne's opinion, we are informed that the apparatus provided by the Company is strictly in keeping with the conditions of the Act of 1871 and the award. Part 1 of Schedule A of the Gas-Works Clauses Act, 1871, clearly and distinctly prescribes that the photometers to be used in testing the gas shall be a "Letheby open 60-inch photometer, or Evans's enclosed 100-inch photometer, together with a proper meter, minute clock, governor, pressure-gauge, and balance." The award defines "that the photometers to be used shall be of the type known as Evans's enclosed 100-inch photometer, having a Keates candle-balance, together with the other apparatus described in Part 1 of Schedule A of the Gas-Works Clauses Act, 1871."

Mr. Mayne is right in his contention when he says that "all Acts regulating the testing of gas, including the Act of 1871, as well as the award, provide for a proper and reliable test, on instruments which were the best of their kind at the time the Acts mentioned were [illegible]" and I challenge him to point out, if he is in a position to do so, if in any way, or in what particular, the photometers in Tara Street differ from the photometers referred to in the Act of 1871 and the award, or, as alleged, are defective, or to point out any cogent reasons why proper and reliable tests cannot be made on the instruments.

The Company have provided proper and sufficient apparatus for the testing of gas at the official testing-station—in fact, more apparatus than they were bound to furnish. If Mr. Mayne is of the contrary opinion, I presume he will state in what respect we have failed. This is merely requiring Mr. Mayne to do what the Gas Committee were asked to do so far back as the year 1888, when they alleged, on the report of an inexperienced officer, that the Evans photometer was defective, and of an unsuitable and discarded type.

For the information of Mr. Mayne, I may inform him that all Evans photometers in use prior to, and for long after, the passing of the Act of 1871 had moveable candles; and even recently the Gas Referees of London, when giving instructions to the gas examiners relative to the plumb-lines for plumbing the candles, remarked that their directions referred to the form of photometer prescribed by them in all recently erected testing-places—viz., "a photometer having the position of the candles fixed—and the disc moveable—and do not apply to those box photometers [Evans photometer] in which the disc is fixed and the candles are moveable."

I assert that any duly qualified expert on gas testing can perform as accurate tests on an Evans photometer, having moveable candles, similar to the Evans photometer in the testing-station, as it would be possible for him to obtain on an Evans photometer with stationary candles.

It is clear the object the Gas Committee and Mr. Mayne have in view is to force the Company to use instruments contemplated neither by the Act of 1871 nor the award.

I cannot conclude without calling attention to Mr. Mayne's remark, at the commencement of his letter, that the Company were compelled to erect the new testing-station in Tara Street. Mr. Mayne is well aware that the Company were not compelled to erect the testing-station. In the original reference agreed to, and submitted to the Arbitrators, neither the site for, nor the building of a new testing-station was introduced. The Arbitrators had no power under the reference to oblige the Company to build a station. They were merely asked to say whether or not the site of the then testing-station was a proper one. While the Arbitrators were waiting to take evidence in the case, the Directors, in order to meet the views of the Gas Committee, volunteered, at the request of that body, in the presence of Mr. Mayne, to build a testing-station in Tara Street, provided the Arbitrators approved of the site.

Mr. Mayne replied to Mr. Cotton's letter on the subject of the Chaney incident. As the deputation consisted of Alderman Toole, Mr. Robinson, Mr. T. J. Cotton, and himself, he applied to those gentlemen on the matter; and they stated that their recollection of the interview exactly corroborated his own statement. Passing on to deal with the photometer question, he said :—

In the regulations as to photometric instruments published on May 1, 1892, by the Standards Department of the Board of Trade, which I have now before me, on p. 6 occurs the following: "An Evans photometer having a moveable candle-holder will not be certified." This is exactly what the chief of that department told the deputation—telling them, in addition, the reasons why the Board of Trade had found it necessary to publish the above regulations. The next time the Secretary and Manager of the Gas Company seeks a contradiction from a Board of Trade official, I would suggest that he gets their own published regulations included in the process; it would then be so much more complete. . . . The statement of the Gas Company that this condemned Evans photometer is in compliance with the Act of Parliament will not hold water. The words of the Act are: "Improved Letheby or Evans photometer." The Evans photometers that are now made in compliance with that Act are really reliable instruments, embodying all "improvements" up to date. Evans photometers made nearly thirty years ago—such as the one the Gas Company seek to force on the Corporation—do not comply with the definition "improved" given in the Act in question. The reference to the 23 photometers used in London, which he mentions as not being stamped, is rather unfortunate for his case, as the reason they are not stamped is because they have to be certified by the Gas Referees, who, he states, are the "highest authority in the kingdom." These gentlemen being Board of Trade officials, stamping by the Standards Department is considered unnecessary.

Mr. W. F. Cotton promptly answered the assertions in the foregoing letter as follows :—

Mr. Mayne says that my statement that "the Evans photometer is in compliance with the Act of Parliament" will not "hold water;" and to endeavour to make this appear, he quotes that portion only of the schedule to the Act of Parliament defining the instruments which suits his purpose. He further implies that these words apply to any instruments constructed after the passing of the Act, notwithstanding that they may differ in form and construction from the instruments contemplated at the passing of the Act in 1871. He carefully avoids giving the date of the Act; leaving his readers under the impression that it is a recent enactment. The words of the Act of 1871 are that the instruments "shall consist of the improved form of Bunsen's photometer, known as Letheby's open 60-inch photometer, or Evans's enclosed 100-inch photometer."

It is clear that the word "improved" applied to the improved photometers then in use, which were often undergoing serious alterations, but does not apply to photometers that may have been constructed subsequently, no matter how variable in form. His contention amounts to this—that a gas company working under the Gas-Works Clauses Act (the General Act of 1871) are bound to adopt every alteration which may be made from time to time in the construction of the Evans photometer. He will be a long time before he succeeds in getting any eminent Counsel to put this construction on the Act.

We do not require Mr. Mayne to tell us that the Board of Trade will not stamp an Evans photometer with moveable candles; but this is because they have selected two forms or types of photometers—an

Evans and a Letheby—patterns from which they will not depart; but they have no power whatever to compel the use of them.

The real reason why the Gas Referees have not got the 23 photometers in London stamped is because they are aware that no amount of stamping will keep the instruments in order, and because the officers in charge of the instruments are competent to test for accuracy, and correct the instruments from time to time. When referring to the Gas Referees, he says that, these gentlemen being Board of Trade officials, stamping by the Standards Department is unnecessary. Dr. Tichborne is appointed by the Board of Trade, and paid by the Gas Company, exactly as the Referees are, who are paid by the London Gas Companies. If these gentlemen, as Mr. Mayne says, being Board of Trade officials, consider it unnecessary to have the instruments stamped by the Standards Department, why should it be considered necessary in Dublin, where there is also a Board of Trade official?

As the correspondence had by this time, as Mr. Mayne put it in his last letter, "entered on the stage of contradiction that invariably crops up when any discussion on gas management takes place in Dublin," we shall leave the matters in dispute until some proceedings thereon are taken in the City Council.

PARÁ GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Wednesday, at the London Offices, No. 16, St. Helen's Place, E.C.—Mr. U. J. BURKE in the chair.

The SECRETARY (Mr. T. S. Borradaile) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts, to which reference was made in last week's issue.

The CHAIRMAN, in moving the adoption of the report and accounts, said he thought that, on the whole, the shareholders would agree with him, looking at what the Company had gone through in the past, that there was reason for congratulation on the present state of their affairs. As they would see, in comparing the working of the two past half years, there had been a considerable improvement both with regard to reduction in expenses and increase in revenue. The notable advance in the revenue had been on the residuals. There had been an increase in the sale both of coke and tar—he might say a very considerable increase, considering the amount with which they had to deal. There had also been an increase in the receipts for public lighting; but, he was sorry to say, there had been a slight diminution in those for private lighting. They did not find that the private lighting was expanding at the present time quite so fast as could be wished. But this was not surprising when they considered the state of Brazil in regard to the revolution that was going on; and, as to Pará, the consumers of gas hardly knew how they stood—they did not know, as long as the Government delayed their decision as to whether they would have this or that contract, whether they would have to buy gas, electric light, or oil. The Directors gathered from their Manager's letters that this was why people were now so shy of going in for more fittings, and embarking in gas consumption. On the other hand, looking at the expenditure side of the revenue account, there had been a considerable decrease in the expenditure on coal, and a large reduction in carbonizing wages, although they would not have been surprised if there had been an augmentation, because like other gas companies they had had to considerably raise their stokers' wages. There was a slight increase in repairs; but this was accounted for by the fact that the mains in the lower part of the town had been flooded. In the general charges, there had been a diminution, which looked exceedingly well. He might also mention that there had been a reduction in fines; and this was not only due to the clemency of the Camara, but also to the fact that the Company had been supplying a much better gas—practically 15-candle gas—which they had been enabled to do because the Government had paid their bills more punctually. He believed that on previous occasions the shareholders had been told that, if the Company had been in a better position by the Government paying their accounts regularly, a gas of higher quality would be supplied; and this was now being done. Speaking generally, without going into actual detail, he might say the Company's Auditor (Mr. P. Crellin) estimated that there was an improvement of practically £5000 upon their working as compared with the previous half year, and something rather less when compared with the corresponding period of 1892. Looking to the difficulties the Directors had experienced, owing to the strike of the miners in England (which had made it very difficult to send out coal punctually, besides adding to the expense); looking to the difficulty of the quarantine at Pará, which had been a serious matter for the Directors' consideration; and looking to the fighting that was going on in Brazil, he thought they had reason to congratulate themselves upon being in a position to pay a dividend, though a small one. He believed, in these troublous times, the shareholders would not have been surprised if the Directors had not been able to recommend one. So far he had been speaking of their working; but what would be perhaps more interesting to the shareholders was the question as to what was being done respecting the concession. The Directors had hitherto been in this position: They had been rather tongue-tied in reference to what they were doing in this matter, because they did not want to impart the history of their affairs to people on the other side. Now he thought they were in a position to tell the shareholders exactly how the Company stood. What they had been going through was this: As those present were aware, the contract under which the Company had been working expired in October, 1892. The Directors were then asked to continue the lighting for another year, which they did. This was to give the authorities at Pará time to make up their minds as to what they were going to do. Then the Directors were requested to continue the lighting for a further two years; but they said, in effect, "No; we are not quite in a position at the end of our contract to do this. Our plant has been working for some 30 years; and we are not now in a position to go on supplying gas from hand to mouth in this way. We should have to embark on additional outlay for mains, as well as other expenses; and it is hardly fair we should be asked to do this when we may be 'bowled out' in another year." Well, the Directors then offered to renew the contract for one more year if the Government would be responsible for the expenditure on mains, because some of the mains and other parts of the plant began to want renewing. The Government consented to this; and so the Board agreed to continue the lighting to October, 1894. Then came an advertisement for tenders; but the Directors were no more in a position to tender when this advertisement appeared than they were previously. However, what the Board did was this: They sent to the Government of Brazil a communication, in which they put their case somewhat in this way: "We are prepared to give you such-and-such a light, on such-and-such terms, subject to such-and-such restrictions, provided, if you think it is likely our tender will be accepted, our shareholders will agree to it when it has been accepted by you. We are not in a position to pledge our shareholders before they have agreed to these terms, and until we know that such a tender as we have framed will be accepted by you." The Directors felt that nobody could know better than they—having worked this concern for something like 30 years—what they could afford to give. They thought it would be idle to submit a tender which they were convinced they would never be able to work with the hope of any profitable return. The Directors took a business-like view of the matter. They said: "We can give gas of such a quality; and we must be paid at such a rate. Beyond this we cannot go." It was quite possible, however, that a more speculative company might come to the front, and put forward a tender which would prove more acceptable. The Directors waited a long time to see what would happen; and eventually they received a telegram from their Manager to say that an electric light tender by the Bond or Tramway Company had been accepted. This, however, did not frighten him (the Chairman), because a great deal had been heard of the wonderful things that electric lighting was going to do in England, where it had a much better chance of getting on than it would have in Pará. But in any case, what the Electric Light Company would have to do would be to obtain their capital (this they would find an exceedingly difficult matter in Pará), and get their works ready for the lighting by October next. He left the shareholders to judge how far this was possible. The position, then, was this: The Gas Company were under contract to carry on the lighting until October next; and then, up to the present, the Government had nothing else to lean upon but the Electric Light Company. The Gas Company had been under contract with the Government for 30 years; and the Directors were very loath to press their position at all, and put them in a hole. But still they could not pledge the shareholders to go on supplying fresh capital for the purpose of working from hand to mouth. They therefore thought it was the best plan to address a letter to the President, and show him exactly how the case stood. "You must understand," the Directors said, "that the contract will come to an end in October, 1894, unless fresh steps are taken; and you must see that, on the expiration of that contract, the town may possibly be in darkness. We cannot supply more capital to go on with, because we can hardly expect the shareholders to supply capital for another year; and consequently if you wish the Gas Company to go on helping you over the stile, you must be responsible for the capital." The letter of which this was the pith had only just been forwarded; and what the result would be, he (the Chairman) did not know. Perhaps the Government would help the Company with capital, or they might accept the proposal which had been submitted by the Directors; but, of course, this was, to a certain extent, handicapped by the fact that an electric lighting tender had been accepted. As he had said, personally the electric light did not frighten him. He did not think it likely it would become a general light in Pará, though he believed it was exceedingly probable that for a year or two it would be puffed; but in the long-run, when they came to put up overhead wires (which were found so objectionable in other parts of America), he did not think they would be able to carry on the public lighting better than the Gas Company had done. This was exactly how matters stood at present; and as soon as the Directors received an intimation as to what the Government proposed to do, they would put the shareholders in possession of the information. Of course, if the contract was accepted, then it would be necessary to call the shareholders together to ask whether they would accept the suggested terms. There was no doubt, however, they must have some more capital; and as far as he could see, the Company would have to be reformed and the capital revoted. As he had already remarked, it would be idle to put forward a speculative form of tender; and that position had been rather accentuated by the coal strike here and the quarantine regulations in Brazil. They could not keep a year's supply of coal out there; and the quarantine had become a very serious thing—indeed, at one time their Manager was doubtful as to whether they would be able to get coal to Pará at all. The Directors had had to charter a steamer to carry out 2000 tons; but that was an exceedingly expensive way of sending out coals.

Captain J. WALROND CLARKE seconded the motion.

Mr. CUFF thought that the shareholders must feel satisfied, under the circumstances, with the improved report on this occasion. It seemed to him the authorities were treating the Company a little more leniently in the matter of fines. He did not know whether the Directors ascribed this to any extent to their hope that it would enable the Company to put in a more favourable tender than they would otherwise do. He trusted it would not influence the Board in that way; and he urged them to secure the Company, as far as they could, against the unjust treatment they had met with in the past.

The CHAIRMAN said he was afraid there might be a great deal in Mr. Cuff's suggestion, though he did not like to say so actually. But he thought the way the Company had been treated recently was not perhaps entirely without an eye to the fact that they were tendering. With regard to the fines, the Board had been greatly exercised as to how they could avoid them. What he (the Chairman) had proposed was that they should not be under the power of being fined on the mere *ipse dixit* of an officer of the Camara, who was thereby benefited, but that there should be some automatic check on the lighting—such as the average meter system, as was in vogue in London. However, the conditions out in Pará were so dissimilar to those in London, as to induce their Manager to look with anything but favour on that system. Replying to a further question, he stated that, in arranging to continue

the lighting for another year, the Directors insisted upon being exempt from fines to a certain extent.

The motion was then carried.

Resolutions were next passed, declaring dividends at the rates of 7 per cent. per annum, less income-tax, on the £5 per share called up on the preference shares, and 2 per cent. on the ordinary shares.

On the motion of Mr. DODGSON, seconded by Mr. SELLS, the retiring Directors (Mr. T. Rumball and Captain Clarke) were re-elected; and on the proposition of Mr. CUFF, seconded by Mr. GODWIN, the Auditor (Mr. P. Crellin) was reappointed.

Mr. CRELLIN, in thanking the shareholders, said he thought the extension of the Company's pier (or *ponte* as it was called) and other changes which had been effected would lead to even a better result in the profits during the current half year than in the past six months.

The CHAIRMAN said that was a point he had overlooked. Hitherto they had had great difficulty in getting large vessels unloaded, because of the wash at the end of the *ponte;* and so the Directors thought it would be better to extend the pier and erect a new crane. This had been carried out at an expenditure of £600; and their Manager estimated that the Company had already nearly saved that amount. The Chairman took this opportunity of remarking that their Manager (Mr. J. R. Hislop) had fully justified the confidence of the Board in him.

The services of the Chairman and Directors, the Secretary, and the Manager were acknowledged; and this concluded the proceedings.

THE ELECTRIC LIGHTING QUESTION IN LONDONDERRY.

The Lighting Committee of the Londonderry Corporation met last Tuesday, under the presidency of Mr. T. S. Magee, to consider the present position of the electric lighting scheme, and the desirability of asking the Local Government Board to make a further advance of £5000, to enable the Committee to completely light the city with arc lamps. The following statement of the financial position of the undertaking appeared in one of the local papers on the following day: The present contract is for 160 lamps; and it is estimated that about 60 more—making a total of 220—will be required. The running power of the machinery is 240 arc lamps; and there are a spare engine, boiler, and pair of dynamos to run 160 more in case the city so extends as to render this necessary. In the meantime, they are merely kept in the station as a stand-by in case of accident to the other plant. The accepted tenders for buildings, boilers, engines, and the entire electrical plant amounts to £14,193; and the extra expenditure on these, as far as ascertained, amounts to a sum of £300 only. The cost of the site of the generating station is £600; and the law costs exceed £500. The engineers' fees will amount to nearly £900. The cost of opening and closing the streets for laying the cables totals up to £503 10s. 8d. The payment for royalty on the lamp-pillars made locally was £100, and £75 for 10 additional pillars. The Clerk of Works costs £75; and other items of the account represent a sum of about £400. The expenditure and liabilities of the Corporation up to this date are represented by the total of the foregoing—about £17,000; and the difference between this sum and £20,000 will be required in case the additional lamps are erected. The annual working expenses of the station will be: Electrician in charge, £200 per annum; engine-driver, £80; stoker, £52; dynamo attendant, £52; and two lampmen (at 18s. each), £93 12s. The coals will cost about £500; and oil, waste, and carbons for lamps, £429—making a total of about £1400 per annum. The Corporation pay the Gas Company £2500 per annum. The difference between these two annual sums will pay off the Government loan, and make ample provision for depreciation, renewals, and repairs.

As the foregoing figures were put forward with some authority—being contained in what was published as an "official report" of the Committee's meeting—we shall not presume to criticize them, especially as this has been very well done by the *Londonderry Sentinel*. A few extracts from a leading article in that paper will here be interesting. The *Sentinel* first of all characterizes the report as a "document full of misstatements intended to hoodwink the citizens and conceal the existing alarming state of affairs." The writer then proceeds to justify this assertion as follows: "The report, in the first place, omits to mention that the Chairman was forced to admit that the lighting of 160 lamps will cost £17,500, irrespective of extras and other necessary expenditure, which will bring the amount up to over £18,000. Yet before his re-election, he told the electors of the South Ward on the 18th of November last, that the cost of 160 lamps would he £15,793. This, no doubt, was merely an electioneering statement; but no clever candidate should commit himself to a statement that can be falsified with two short months. The report further states that 'it is estimated that about sixty' lamps will be needed in addition to the 160. Now, if 160 lamps have cost over £18,000, it is evident that 60 more will cost considerably more. They cannot cost much less than £2820. Thus nearly £21,000 is accounted for, even if 'about sixty' really means 'only sixty,' which is very questionable, judging by the experience of the past in connection with the scheme." The next matter dealt with is the statement in the report in regard to the opening and closing of the streets. Instead of being £508, the writer says this item should be within a few pounds of £620. He then goes on to show that there are other misrepresentations in the report. The producer of that document, in a desperate attempt to prove that the light will not be introduced at a loss of £1000 or £1500 a year, after lowering the annual cost for maintenance of electricity and raising the annual charge of the Gas Company, makes the assertion that the difference between £1400 and £2500—viz, £1100—will "pay off the Government loan, and make ample provision for depreciation, renewals, and repairs." The *Sentinel* writer says on this matter: "Of all the statements that have been hurled at the heads of the citizens, this is perhaps the most astounding. It is not only based on wrong premises, but is absolutely wrong in itself. It is based on the assumption that the Gas Company charge the Corporation £2500 for the lamps which will be extinguished when the new illuminant gives forth its first spark; whereas the Company, cording to the last annual statement of the Corporation accounts, only charge the Corporation £2145 12s. 10d.—a difference of over £300 a year." This reduces the margin of £1100 to £745; and the writer points out that this is insufficient by about £130 to repay the loan of £15,000. Where, then, he very naturally asks, is the "ample provision for renewals and repairs." The repayment of the loan of £15,000 averages £873; but as another £5000 at least will have to be borrowed, the amount must be one-third more, or £1164. So that, according to the "official report," there will be only £745 available out of which to pay £1164; and even then nothing will be available for depreciation, which should be put down at (at least) £1000 a year. This is accepting as correct the Lighting Committee's own estimate of the annual cost of maintenance; but as other estimates have not been altogether accurate, it may be the same with regard to this one. Summing up the matter, the *Sentinel* says: "It seems to us that 220 lamps will cost the city at least £20,000; that the average repayments on £20,000 will be £1164 a year for 25 years, and to meet this the Committee will only have £745; and they will, in addition, require to allow at least £1000 a year for depreciation. The working expenses will be £1400. Thus the loan, working expenses, and depreciation allowance will reach £3664, or £1500 more than the lighting of the city by gas costs. Councillor Magee on Oct. 11, 1892, promised a margin of profit of £200 a year on an expenditure of £15,000. His organ echoed that promise. Councillor Magee, on Nov. 18, 1893, judiciously dropped reference to the profit, but promised a 'beautiful electric light' 'without asking the ratepayers to contribute a single penny.' The Chairman is a greater financial genius than we take him to be if he can show how the citizens are to pay £1500 a year more for electric light than gas without 'contributing a single penny.'"

The Belper Water Company and the Local Board.—In consequence of the scarcity of water to many parts of the town, the Belper Local Board recently determined to open negotiations with the Water Company for the purchase of their property. The Directors favoured the proposal, which, however, had to receive the approval of two-thirds of the holders of stock before any decision could be given. The shareholders have since held a meeting, and unanimously passed a resolution empowering the Directors to treat with the Local Board with a view to purchase.

Water Supply in the Preston Union.—An application was recently made to the Local Government Board for sanction to a loan of £10,000, proposed to be raised by the Rural Sanitary Authority of Preston, for works of water supply in the villages within its area. An inquiry into the matter was recently held by Major-General Crozier, one of the Board's Inspectors; and as the result the Board have advised the Authority to enter into an agreement with the Preston Corporation for an adequate supply of water for a fixed period. On receipt of the agreement, the Board intimate that they will be prepared to consider the application for the loan.

The Discharge of Gas Refuse into the Sewers at Dorking.—Several times of late a question regarding the discharge of refuse from the Gas Company's works into the sewers has been before the Dorking Local Board; and a Special Committee were instructed to consider the matter. They forwarded a portion of the refuse to Dr. Stevenson for analysis; and, having received his report, they recommended the Board last Tuesday to call upon the Company to forthwith take steps to prevent any gas or trade refuse whatever being discharged from the works into the sewer. On the request of the Clerk, it was decided to consider the subject in Committee.

Discoveries of Coal.—An important discovery of coal has lately been made on the Kinlet Estate, which adjoins the extensive Bewdley Forest; and there have been great rejoicings at Bridgnorth in honour of the event. A splendid seam of coal 24 feet deep has been found at a depth of 300 yards; and it is believed that there are very great possibilities in this coal-field, which must lead to important developments. The boring operations have been so far carried out that the first shaft has been constructed, and the mining machinery is about to be erected. It is confidently expected that the discovery which has been made will lead to the complete opening out of the extensive district in mining operations, as it is held by competent mining authorities that the coal-bed extends from the edge of the Bewdley Forest to the Clee Hills. A discovery of coal has also been made at Forest Row, Kent. A party of men, while engaged in sinking a well, came upon a thick seam of coal. This is the second discovery of the kind in the county—a similar seam having been struck in some brick-fields on the borders of Kent and Sussex. Samples of the fuel have been tested, it is stated with highly satisfactory results. A Committee has been formed for the purpose of prosecuting experiments.

The Recent Explosions in Electric Light Boxes.—A report on the recent explosions in boxes belonging to the City of London Electric Lighting Company on Ludgate Hill and in St. Paul's Churchyard, has been issued by Mr. W. H. Preece, whose attention, it may be remembered, was called to the matter by the Commissioners of Sewers. He states that the two explosions occurred simultaneously in a box in Creed Lane and in another nearly opposite the premises of Messrs. Howell in St. Paul's Churchyard—a distance of 55 yards apart. The effect of the explosion was to blow the covers of the boxes to a considerable height in the air. One of them broke in falling; while the other made a hole in the pavement, and stood upright in the aperture it made. One person (a boy) was injured. A careful examination of the boxes revealed the fact that the explosions were caused by an accumulation of coal gas and air in the pipes and boxes. The cables carrying both the public and private current were in good condition; and the electrical tests proved that there was no leakage on the circuit to cause the accident. At the time of the explosions, some of the Company's men were working at a distance of 50 yards away; and they were using a red-hot plug, or "rat." It was possible, Mr. Preece says, that this red-hot iron might have ignited the gaseous mixture. The City of London Electric Lighting Company have since introduced a system of inspection of boxes; and by extra vigilance on the part of the employees it is believed that immunity will be secured from such dangerous explosions in the future.

METROPOLIS WATER SUPPLY.

The Quality of the Water during December.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 182,927,690 gallons, as compared with 174,939,419 gallons in the corresponding month of 1892. The number of services being 800,565, the rate was 228 gallons to each service. Of the entire bulk of water sent out, 94,505,985 gallons were drawn from the Thames, and 88,421,705 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies was: Tottenham, 1·1; Kent, 1·4; Colne Valley and East London (deep well), 1·5; New River, 1·9; Chelsea, 2·8; West Middlesex and East London (river supply), 3; Lambeth, 3·1; and Southwark and Grand Junction, 3·2. The unfiltered river waters contained the following proportions: New River Cut, 1·5; East London intake, 4·3; and the Thames at Hampton, 3·8. The Thames at Hampton was turbid and yellow on the 7th of December; it was, however, chemically of fairly good, but bacterially of very inferior quality. Contrasted with the unfiltered water, the supplies of the five Companies drawing from the river showed considerable chemical, and the following percentage bacterial, improvement: Chelsea, 99·89; West Middlesex, 99·93; Southwark, (No. 1 filter, Battersea works) 97·15, (tap on main, Battersea works) 98·61, (No. 4 filter, Hampton works) 99·60; Grand Junction, (general filter well at Hampton, Dec. 25) 97·21, (ditto, Dec. 29) 99·49, (south well, Dec. 25) 99·56, (ditto, Dec. 29) 99·68; and Lambeth, 96·80. The water was in every case efficiently filtered before delivery. The unfiltered water, taken chiefly from the River Lea by the New River Company, was turbid and pale yellow on Dec. 8. It was chemically of very good, but bacterially of inferior quality. It was efficiently filtered before delivery, and was improved bacterially to the extent of 99·35 per cent. The crude river water of the Lea, at the East London Company's intake at Angel Road, was turbid and yellow. Both chemically and bacterially, it was of much worse quality than on Nov. 10. The intake was, however, closed at the time my sample was taken. It was efficiently filtered before delivery, and considerably improved in respect of chemical purity. Compared with the raw river water collected on the previous day, the number of bacteria per cubic centimetre was reduced to the extent of 99·21 per cent. The deep-well waters of the Kent, Colne Valley, Tottenham, and East London Companies were of excellent quality for dietetic purposes. They were clear and bright without filtration; and the Colne Valley Company's water was softened before delivery, and thus rendered suitable for washing. The Kent Company's deep-well at Plumstead yielded water of even a higher degree of organic purity than was the case in 1873, when I first examined it. The proportion of chlorine is now slightly less; but that of nitrogen as nitrates has considerably increased, though not to such an extent as to throw any suspicion upon the wholesomeness of the water. The bacterioscopic examination of this water is also satisfactory. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and East London (deep-well) waters were clear and colourless; the New River, clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters, and of those supplied by the various Companies, collected on the 7th, 8th, 11th, 25th, and 29th of December, gave the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw River Waters.		
Thames at Hampton	6,316	5·4
New River Cut	3,408	5·4
Lea at Angel Road	11,842	5·5
„ after storeage	1,369	5·5
River Supplies.		
Chelsea	7	5·3
West Middlesex	5	5·4
Southwark (Filter No. 1, Battersea works)	180	5·7
„ (tap on main „ „)	88	6·3
„ (Filter No. 4, Hampton works)	25	5·6
Grand Junction (general filter well, Hampton, Dec. 25)	176	6·3
„ „ (Ditto, Dec. 29)	32	6·2
„ „ (South well, Hampton, Dec. 25)	28	6·2
„ „ („ „ Dec. 29)	20	6·1
Lambeth	202	5·4
New River, main filter well	22	5·7
East London, No. 1 Essex well	94	5·5
Deep Well.		
Kent, Plumstead well	30	11·5

In the course of their report for the past month to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.), Messrs. Crookes and Odling say: "Of the 168 samples examined, all were found to be clear, bright, and well filtered. During the month of December, the changes in the chemical constituents of the Thames-supplied waters have been very slight. The decrease of temperature and the diminished amount of oxidation through the agency of plant growth have been followed by a minute, but wholly unimportant, increase in the organic carbon present, shown alike by the 'combustion,' the 'oxidation,' and the 'colour tint.' The increase, however, in each case is very small; the amount being, in fact, lower than it was in either of the months of December, January, February, or March last, although a trifle higher than in November. The following table shows how favourably the month just ended compares with the corresponding month of last year:—

	Nitric Acid.	Hardness in Degrees.	Oxygen required per Gallon.	Organic Carbon per Gallon.	Colour. Brown : Blue.
Dec., 1892	1·054	17·70	0·060	0·134	22·8 : 20
„ 1893	0·935	16·36	0·044	0·096	19·4 : 20

Note.—All the figures are means.

The singularly small rainfall which characterized most of the months of the year 1893 was continued to the end. The actual fall at Oxford during December was only 1·72 inches; whereas the mean rainfall for 25 years is 2·10 inches. The deficiency has therefore been 0·38 inch. With the exception of February and July, when the fall was decidedly above the average, and October, when the mean fall was only just exceeded, every month was conspicuously deficient in rain. The unusual character of the past year in this respect may, perhaps, be better appreciated if the rainfall is given in a tabular form, as set forth below:—

	Actual Fall.	Mean of 25 Years.	Deficiency.	Excess.
January	1·88	2·26	0·38	—
February	2·64	1·92	—	0·72
March	0·18	1·59	1·41	—
April	0·06	1·78	1·72	—
May	0·84	1·95	1·11	—
June	0·77	2·21	1·44	—
July	3·70	2·58	—	1·12
August	1·01	2·24	1·23	—
September	0·57	2·66	2·09	—
October	2·65	2·56	—	0·09
November	1·68	2·31	0·63	—
December	1·72	2·10	0·38	—
	17·70	26·16	10·39	1·93

It is thus seen that there is a deficiency over the whole year of no less than 8·46 inches of rain, or nearly one-third of the mean quantity falling on that part of the gathering-ground of the Thames Valley supplying the chief sources of the river."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have a very light budget of "Notes" this week, the reason for which I am at a loss to explain. Perhaps the most important item of information which I have been able to lay my hands upon is that a conference of representatives of County Councils was held in Edinburgh on Wednesday, at which the subject of amending the Local Government (Scotland) Act was discussed; and on the motion of Mr. Bine Renshaw, M.P., it was resolved to recommend that in the amending Act power should be given to County Councils to introduce compulsorily a water supply to populous places, and to form lighting and cleaning districts. The unanimous adoption of such a resolution, I take to indicate a rise in the aspirations of rural communities towards better conditions of living. When may we expect to have County Councils owning gas-works for the supply of light to populous places, as we have municipalities doing at present? The notion is not altogether a dream. Sanitation is now being pushed so far in rural districts, that many of the discomforts of residence beyond town boundaries—such as defective water supply and absence of cleansing—are disappearing. With their disappearance, and the introduction of better water supplies and cleansing, a more desirable class of residents may be expected to make their homes in districts which are now avoided by many; and the result will be a demand for light. There are many districts within the jurisdiction of County Councils where a gas supply might be provided with profit, but is not, because of the want of machinery for the bringing of it into existence. With power in the hands of County Councils to light the thoroughfares in certain districts, there will be ready to hand the means for instituting lighting arrangements; and therefore it is not by any means improbable that, before many years are over, we may have gas-works as well as water-works owned and managed by County Councils for the supply of suburban localities and populous districts further afield.

It is not, I suppose, generally known that the patent relating to the Young and Bell oil-gas process was only recently sealed. There was a good deal of delay, on account of proceedings before the officials in the Patent Office; but these are now all exhausted, and the invention is the absolute property of the Company who acquired it from the patentees. Licences to work the system may now be granted freely and unrestrictedly. I am told that the process is already in operation in fourteen places, two of which are in England; and that from every one the accounts which are received are that it gives no trouble in working, and that the results quite justify the representations of the inventors. There are, too, numerous inquiries regarding the terms upon which the Company grant their licences, literally from all parts of the world—from America, Australia, and the Cape—which, in one aspect, may be taken as a testimony to the wide circulation of the JOURNAL, for the process received its first, and has all along had its fullest treatment in your columns. It is quite in expectation that one of the large railway companies will shortly relinquish the manufacture of oil gas by the Pintsch process, and adopt the Peebles. The difference in the cost of oil will make it profitable for all railway companies to do so. For the Pintsch process, the oil which is suitable is said to cost about 7d. per gallon; whereas gas of equally high illuminating power can be made by the Peebles plant from oil at half that price. The Peebles gas, too, has the advantage in respect of the marketable nature of the residuals; and, further, being an absolutely permanent gas, it stands compression without depositing liquor. On this subject of condensation, I have made inquiry regarding the behaviour of the gas during the recent severe frost, which was by far the lowest temperature to which it has yet been subjected; and I have been informed that there was not a particle of condensation, which shows a very high standard of permanency. I understand that the experience which has been gained in the working of the process, has shown that an improvement may be effected in the plant—not entailing an alteration upon the process—which will enable it to be fitted up at less cost than the first ones erected. This will be good news for those who contemplate adopting the process; and on that point, I may say that an experimental plant is, I understand, being fitted up in one of the works of the South Metropolitan Gas Company, while another is likely to be erected at one of the stations of the Glasgow Corporation.

Two London gas engineers were in Falkirk yesterday in the interest of the Police Commissioners, who are in Parliament seeking powers to

assume the lighting of the town. They went over the district, and inspected the site of the proposed new gas-works; and afterwards they met the Lighting Committee of the Police Commission, to give their opinion of what they had seen. They were not permitted to inspect the works of the Falkirk Joint-Stock Gas Company; the Directors of the Company, it is reported, having refused to allow them to do so, on account of the Corporation being in Parliament promoting a Bill to enable them to compete with the Company. No fault can be found with the Directors in declining to allow the works to be inspected—more particularly as the Corporation have not distinguished themselves in the matter of *bonâ fides*, but have shown a desire rather to steal a march on the Company than to come to an agreement with them.

It may not be out of place here to point out an element in the coal trade which may have a disturbing effect when contracts for the year come to be fixed. During the long strike in England, stocks in many gas-works, as is well known, were all but exhausted. There is now a desire to, as far as possible, replenish them; and the consequence is that all descriptions of gas coal are being freely taken up. That should be only a temporary movement; but, of course, the coal-owner is very glad to book forward orders, and is getting them, I suppose, on account of the fear of another stoppage of supplies nearer home. The same thing may therefore happen as was experienced two years ago, when home consumers found that nearly all the available cannel was snapped up by southern and foreign purchasers. The probability is, on this ground, that prices will rule higher in the next than they do in the present contracts.

Referring to the electric lighting movement at Stirling, on which I made some comments last week, I may say that the Council are forced into the matter, and have not taken it up of their own accord. In this connection, it is interesting to note that ex-Provost Yillowlees, one of the deputation to the Council, informed them that, in "Scotland, municipalities who had large means at their disposal had themselves applied for Provisional Orders." He might have said that they had been compelled to do so, as they all have, as a matter of fact. The ex-Provost, notwithstanding that he was himself attempting to force electric lighting upon the community of Stirling, contrived to find arguments which convinced him that the supply should be entrusted to a Company. His appearance in the Council Chamber was rather of the nature of an impertinence. But if impertinence is to be spoken of, what is to be said of the doings of the Caledonian Electric Supply Company? The Company is an offshoot of the Brush Company, and has a subscribed capital of only £100. Yet they have memorialized the Board of Trade in terms which I hope they will blush for yet. In this document they recount that they gave notice to the Corporation on the 30th of June, but that no steps were taken to convene a special meeting of the Council till the 4th of December, and then only upon a requisition by twelve members of the Council; that they repeatedly, in interviews with members of the Council, stated that they would not lodge their application with the Board of Trade if the Corporation were themselves to apply for a Provisional Order; that they repeatedly asked the Council to state the terms upon which they would give their consent to the application of the Company; that they were under the belief, induced by the statements and actings of the Corporation, that the latter had no intention of applying for a Provisional Order; that, an hour before the special meeting of the Council on the 8th inst., a private meeting was held in the office of one of the members of the Corporation, of those opposed to the Company, at which the members, with the exception of two, pledged themselves to vote against the application of the Company; that they believe and aver that the Corporation had no *bonâ fide* intention of applying for an Order; and that the resolution of the Council is opposed to the wishes of the ratepayers. They therefore ask that the consent of the Local Authority may be dispensed with. The Town Council had the memorial before them on the 16th inst., and resolved to lodge answers to it. This should not be difficult to do. Had a section of the ratepayers in the town been the memorialists, they could not have spoken with more conceit. To take only one instance, the memorialists allude to the wishes of the ratepayers. That is founded upon the requisition of 400, which is not one-sixth of the electorate. It was not stated that all the requisitionists were prepared to have electric lighting; and it is, unless Stirling be very different from other places, a certainty that not nearly so many as 400 will take it up. The pity is that the Board of Trade have the power to grant or refuse a Provisional Order irrespective of the wishes of the community. That is, in effect, what the Caledonian Company are at present moving the Board of Trade to do. It is themselves, therefore, and not the Town Council, who are acting contrary to the wishes of the ratepayers.

Sulphate of ammonia continues to rise in price. This week a Glasgow oil company got £14 per ton; and the price is expected to harden yet.

Projected Gas Exhibition at Derby.—The Derby Gas Company, in co-operation with Messrs. Richmond and Co., Limited, of Warrington and London, and the Davis Gas-Stove Co., Limited, are arranging for an exhibition of all kinds of gas appliances, including exhibits by Messrs. D. Hulett and Co., Limited, of London, and Messrs. Webb and Son, of Leicester, from the 13th to the 23rd prox., in the Temperance Hall, Derby. The exhibition will be opened by the Deputy-Lieutenant of the county.

The Price of Coke at Huddersfield.—Some questions were put to the Chairman of the Huddersfield Gas Committee, at a meeting of the Council last Wednesday week, as to the price charged for coke From these it would seem that the Committee are disposing of coke to the Electric Lighting Committee for 6s. per ton, while other customers are charged 8s. 4d. Alderman Stocks explained that the Electric Lighting Department contracted for a supply of coke all the year round, while the other business was of a casual nature. So long as the Gas Committee could get 8s. 4d. a ton, it was, he contended, their duty to sell it at that price. When the stocks accumulated, the price would have to be lowered. One or two members thought that more consideration should be shown for the poor ratepayers; but beyond this expression of opinion no opposition was offered to the Committee's policy.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 27.

Sulphate of Ammonia.—The market is advancing steadily; and business is reported at £13 17s. 6d. and £14 for prompt and forward. The principal demand has been for the Colonies; and some also for America. Continental buyers stubbornly refuse to move; but it is difficult to perceive how their attitude will benefit them, as sulphate even now seems as scarce as generally during the summer months. The exceptionally bright and open weather will account for this. Stocks of any importance have, of course, not existed for a long time past. Nitrate is being strongly pushed, on account of the dearer sulphate prices; but one can never be a substitute for the other to any appreciable extent. If there is no change in the weather, large orders may be expected from Continental consumers next month.

LONDON, *Jan.* 27.

Tar Products.—The market for tar products has, generally speaking, been somewhat easier during the past week. Benzols especially have drooped; and, even at the lower prices quoted, business has been difficult to carry through. Solvent and other naphthas have been similarly affected. Carbolic acid has been in slightly better demand, and is a shade better in value. Pitch is quoted at about last week's prices, although there is not the same anxiety on the part of consumers to contract far ahead. Creosote remains scarce; and the price good—several large contracts for forward delivery having been placed last week at current prices. Anthracene is steady at the Tar Products Committee's prices. Prices are as follows: Tar, 15s. to 17s. Pitch, prompt, 29s.; forward, 27s. Benzols, 90's, 1s. 3d.; 50's, 1s. 4½d. Creosote, 1⅜d. Creosote salts, 25s. Solvent naphtha, 1s. 3d. Toluol, 1s. 8d. Crude benzol naphtha, 30 per cent., 7½d. Carbolic acid, 60's, 1s. 8d.; crystals, 6d. Cresol, 1s. 4d. Anthracene, 30 per cent., "A," 1s. 2d.; "B," 10d.

Sulphate of Ammonia has considerably improved during the week; and a large business has been done at prices ranging from £13 15s. to £14 5s., less 3½ per cent.; and contracts closely touching the higher figure can be booked for delivery to the end of the year. Gas liquor is quoted at 8s. 6d. to 9s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—If anything, the tendency of prices in the coal trade of this district continues in a weakening direction; and although there is no actually quotable giving way, so far as list rates at the principal Lancashire collieries are concerned, there is a good deal of competition with coal coming in from other districts. The better qualities of round coal are only in moderate demand; requirements for these having fallen off considerably. Here and there small stocks are accumulating; while in isolated cases colliery proprietors have not been able to keep their pits on quite full time. For special qualities of Arley, 15s. is still quoted; but ordinary best descriptions average 14s. to 14s. 6d.; Pemberton four-feet and second Arley, 12s. 6d. to 13s.; and common house-fire coals, 11s. to 11s. 6d. per ton at the pit mouth. The lower qualities of round coal, for steam and forge purposes, move off fairly well; but supplies are plentiful for requirements, and 10s. to 10s. 6d. represent the full average prices for ordinary qualities at the pit mouth. For shipment, prices remain fairly steady at about 12s. to 12s. 6d. per ton, delivered at the ports on the Mersey. So far no very great weight of coal has been shipped on the Manchester Ship Canal; but at the Partington coal-tips moderate quantities have been coming in from Yorkshire. As this point of the Canal is in very close proximity with some of the West Lancashire collieries, it is expected that considerable trade will be developed here, which will divert some of the business from the ports on the Mersey. Engine classes of fuel are in fairly good demand; and with lessened activity in round coal, the output of slack has necessarily been somewhat restricted. Prices are not more than maintained at 8s. to 8s. 6d. for the best qualities of burgy; 6s. to 6s. 6d., for the better qualities of slack, with some special sorts quoted at 7s.; and 5s. to 5s. 6d. for inferior descriptions.

Northern Coal Trade.—There is now much less anxiety as to the coal supply; and with a slight reduction in the consumption of some kinds of fuel, there is a decided ease in the market. Best Northumbrian steam coals are still fairly steady, with a good demand, though not so strong as a fortnight ago or so. The price generally quoted for best steam coals for early shipment is now from 12s. to 12s. 6d. per ton f.o.b.; and so far there is full work. For second-class steam coals, about 1s. per ton less is quoted. Small steam coals are now in such full supply that some collieries have again a stock at bank; and the price is easier, at from 4s. to 4s. 3d. per ton. There is still a very large demand for gas coals, and the deliveries to the South are maintained at a high rate; but it is expected that next month will see some reduction of these quantities, though there may be enlarged shipments under contracts that are now being negotiated for many of the countries on the Continent. One such contract for Austria is already decided; and it is stated that the price will be equal to from 7s. 3d. to 7s. 6d. per ton f.o.b., though the exact yield to the shippers will depend on the range of freights in the summer. For occasional supplies of best Durham gas coals, the prices range from 8s. to 9s. per ton f.o.b. Manufacturing coal is plentiful, and is easier in price. In coke, there is rather more business; but the high price militates against large exports. The general quotation varies from 15s. to 15s. 6d. per ton f.o.b; bnt supplies of poorer qualities are obtainable down to 14s. per ton. Gas coke is quiet; but there is still a fair shipment to some of the Continental ports, which keeps down the stocks despite the heavy production at this season of the year.

Scotch Coal Trade.—Except steam coal, for which the request is not so great, Scotch coal has been moving off very freely. There seems to be still a very large demand from England—some of it the working off of orders that were given during the strike, and some due to the desire to stock, in anticipation of trouble with the miners.

Shipping facilities are not able to cope with this southward movement of coal; and the railway companies are reaping a rich harvest in increased traffic. The miners are working very steadily, and are, in fact, producing more than can be taken away by ship and rail. A conference has been called for next week, to consider a proposal to ask an increase of wages; but now that the Conciliation Board question has been practically settled in England, there is every probability that some similar arrangement will be come to in Scotland. On both sides, it is likely that an effort will be made to secure this, before a threatening attitude is taken up. Gas coal is reported to be in demand; the stocks being in many cases light, and forward contracts coming in freely. The prices quoted are: Main, 9s. 3d.; ell, 9s. 9d. to 10s.; splint, 9s. 6d.; and steam, 10s. 6d. f.o.b. Glasgow—being mostly a decline upon last week. Shipments are again very high, amounting to 165,298 tons—an increase upon the previous week of 37,166 tons, and upon the corresponding week of last year of 48,750 tons. For the year to date, the total shipments have been 394,610 tons—an increase upon the same period of last year of 110,371 tons.

Colne Valley Water Company.—In the report for the six months ending Dec. 31 last, which the Directors of this Company will present to the shareholders at their half-yearly meeting on the 13th prox., it is stated that a dividend at the rate of 3¾ per cent. per annum will be recommended. The net profit amounted to £4192; and the balance available for division is £2730. After the ordinary meeting, the shareholders will be asked to approve of the Bill which has been promoted to obtain the sanction of Parliament to the purchase by the Company of a portion of the district of the Central Middlesex Water Company, to which reference was made in the JOURNAL last week.

Beyrout Water-Works Company, Limited.—The annual meeting of this Company was held last Tuesday, at the London Offices, 17, King's Arms Yard, E.C. In submitting for adoption the Directors' report and the accounts, the Chairman (Mr. Edward Easton) remarked that the concern was steadily progressing; and that the balance carried forward on this occasion showed a satisfactory, though small, increase. The gross revenue for the year amounted to £12,834, as compared with £12,634; being an increase of £200. After making proper allowances for proportion of cost of new machinery and depreciated value of plant, and carrying £1000 to reserve for contingencies, there remained a net balance of £6945. The Directors had resolved to raise the rate of interest on the ordinary debentures from 3 to 4 per cent.: the increase on revenue during the last few years enabling them to take this step. Mr. J. Morris seconded the motion, which was carried. The retiring Directors (Messrs. W. T. Western and D. B. M'Lachlan) and the Auditors (Messrs. E. Moore and Sons) were re-elected.

York United Gaslight Company.—Reporting upon the working of the past six months, the Directors of this Company state that the revenue account shows a balance of £7891 to the credit of profit and loss. This amount, after being charged with £348, the interest upon money borrowed on mortgage, leaves £7542 available for the half-year's dividend, amounting to £7000, and leaving £542 to be carried forward to the general revenue balance. This result the Directors feel sure will be regarded with satisfaction by the shareholders; and they recommend that the usual dividend of 5s. per share upon both the old and new shares be declared, free of income-tax. The increase in the half-year's profit, the Board remark, has been helped by two causes—first, by the Directors having anticipated the disastrous effect of the late coal strike, and secured the current year's supply of coals at prices ruling immediately before that event; and, secondly, by the comparative absence of exceptional expenses. The net result of the working enables the Directors to announce a reduction in the price of gas of 1d. per 1000 cubic feet, from the end of the current quarter. With this reduction, the scale of charges will range, according to the quantity of gas consumed, from 1s. 11d. to 2s. 2d.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 188.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Oct.	10½	Alliance & Dublin 10 p. c.	10	17½–18½	+½	5 13 6
100,000	10	,,	7½	Do. 7 p.c.	10	12–13	+½	5 15 5
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107	..	4 13 4
100,000	20	14 Dec.	8	Bahia, Limited	20	10½–11½	..	13 18 3
200,000	5	15 Nov.	6¼	Bombay, Limited	5	4½–5	–⅛	6 10 0
40,000	5	,,	6¼	Do. New	4	3¾–4	..	6 10 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated . .	100	220–225	..	5 2 2
180,000	,,	,,	8½	Do. New	100	163–168	..	5 1 2
220,000	20	15 Sept	11½	Brighton & Hove Original .	20	41–43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102–105	..	4 15 3
320,000	20	29 Sept.	11½	British	20	43–45	..	5 0 0
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	20–22	+1½	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	15–16	..	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	6–7	..	2 17 2
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	98–101	..	5 18 10
150,000	20	13 July	8	Cagliari, Limited	20	27–28	..	5 14 3
550,000	Stck.	13 Oct.	12½	Commercial, Old Stock . .	100	245–250	..	5 0 0
165,000	,,	,,	9½	Do. New do. . .	100	188–193	..	4 18 5
160,762	,,	14 Dec.	4½	Do. 4½ p. c. Deb. do.	100	125–130	..	3 9 3
800,000	Stck.	14 Dec.	13	Continental Union, Limited .	100	228–233	..	5 11 6
200,000	,,	,,	10	Do. 7 p. c. Pref .	100	198–203	..	4 18 6
535,000	Stck.	15 Sept.	5	Crystal Palace Ord. 5 p.c. Stk	100	100–105	..	4 15 3
486,090	10	28 July	10	European, Limited	10	22–23	..	4 6 11
354,060	10	,,	10	Do. Partly paid	7½	15–16	..	4 13 9
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	235–240	+1	5 0 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	97–102	..	3 18 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	275–280	..	3 11 5
30,000	,,	,,	5	Do. F, 5 p. c. Pri. .	100	125–135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do. .	100	190–195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max .	100	173–178	..	3 18 7
463,000	,,	,,	10	Do. J, 10 p. c. Prf. .	100	270–275	..	3 12 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf. .	100	165–170	..	3 10 7
1,061,150	,,	14 Dec.	4	Do. 4 p. c. Deb. Stk.	100	127–130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130–135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175–180	..	3 6 8
3,800,000	Stck.	15 Nov.	12	Imperial Continental . . .	100	204–209	–3	5 14 10
75,000	5	14 Dec.	6	Malta & Mediterranean, Ltd.	5	4½–5	..	6 0 0
560,000	100	2 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	107–109	..	4 11 9
541,920	20	15 Nov.	5	Monte Video, Limited. . .	20	12¾–13½	..	7 8 2
150,000	5	30 Nov.	8	Oriental, Limited	5	6¾–7	..	5 14 3
60,000	5	29 Sept.	7	Ottoman, Limited	5	4–4½	..	7 15 6
166,870	10	—	2	Pará Limited.	10	1¾–2½	..	8 17 9
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds., . . .	100	98–102	..	5 17 8
500,000	100	1 Dec.	6	2nd Do. . . .	100	96–100	..	6 0 0
150,000	10	13 Oct.	5	San Paulo, Limited . . .	10	8½–9½	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	310–315	..	4 18 1
1,350,000	,,	,,	12	Do. B do. .	100	247–252	+2	4 15 3
260,000	,,	,,	13	Do. C do. .	100	253–258	..	5 0 9
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk. .	100	150–153*	..	3 5 4
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210–215	..	5 7 0
				WATER COMPANIES.				
745,967	Stck.	29 Dec.	10	Chelsea, Ordinary	100	268–273	..	3 13 3
1,720,252	Stck.	13 Oct.	8	East London, Ordinary . .	100	214–218	+1	3 13 5
544,440	,,	29 Dec.	4½	Do. 4½ p. c. Deb. Stk. .	100	143–148	..	3 0 9
700,000	50	14 Dec.	8½	Grand Junction	50	115–119	+2	3 11 5
708,000	Stck.	16 Aug.	11	Kent	100	288–293	..	3 15 1
1,043,800	100	29 Dec.	9½	Lambeth, 10 p. c. max. . .	100	248–253	+3	3 15 1
406,200	100	,,	7½	Do. 7½ p. c. max. . .	100	197–202	..	3 14 3
310,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk..	100	128–131	..	3 1 0
500,000	100	16 Aug.	12½	New River, New Shares . .	100	370–375	+5	3 4 8
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk .	100	133–136	..	2 18 10
902,300	Stck.	14 Dec.	6	S'thwk & V'xhall, 10p. c. max.	100	156–161	..	3 14 7
126,500	100	,,	6	Do. D 7½ p. c. do.	100	145–150	..	4 0 0
1,155,066	Stck.	14 Dec.	10	West Middlesex.	100	265–270	..	3 14 1

*Ex div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

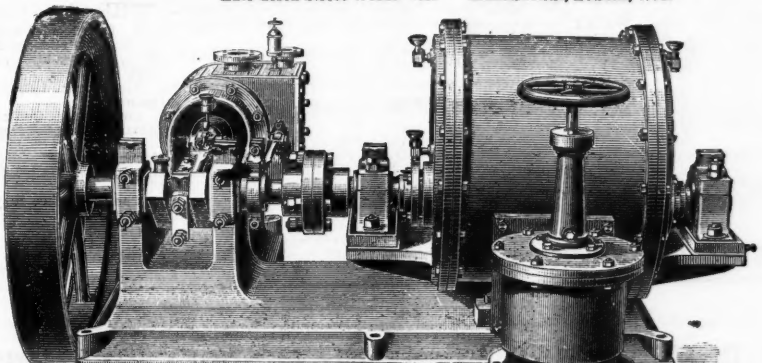
Late Essex Street Works Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications *re* OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See also Advt., p. 131.]
ANDREW STEPHENSON, No. 182, Gresham House, Old Broad Street, LONDON, E.C.

LIQUOR, Tar, and Spent Oxide wanted. BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

ADVERTISER (aged 48) requires a SITUATION as ENGINEER, FITTER, or in any other capacity. Moderate wages. Good references.
Address No. 2330, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a young Man, total abstainer (age 29), a Situation as MANAGER of small Gas-Works. Moderate Wages. Good references.
Address No. 2332, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

REPRESENTATIVE.

THE late Secretary to the Incorporated Gas Institute is open to an engagement as LONDON AGENT or GENERAL REPRESENTATIVE for a first-class Firm.
Please address, W. H. HARVEY, 48, Cromford Road, West Hill, Wandsworth, LONDON, S.W.

WANTED, by a Young Man (age 23), a Situation as ASSISTANT or MANAGER of Gas-Works. Has a thorough knowledge of the Manufacture of Gas and Sulphate of Ammonia on most modern principles. Good Draughtsman. Considerable experience in Extensions, also in the erection of new Works.
Address No. 2324, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Gas Company in South of England, an active YOUNG MAN to lay Mains, fix Meters, take Indices, and do Gas Fitting.
Apply, stating age and salary required, with references, to No. 2334, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COUNTY BOROUGH OF WIGAN.
(GAS DEPARTMENT.)

WANTED, a Meter Inspector.
References only to, and particulars from, the undersigned, to whom applications, in writing, must be addressed.
JOS. TIMMINS,
Engineer, &c.
Jan. 26, 1894.

THE Quaker's Yard Gas and Water Company, Limited, require the services of a competent MAN to undertake the MANAGEMENT and SECRETARYSHIP of their Gas-Works, as from the 1st day of April next.
The Salary will be £100 per annum, with a Bonus of £5 for every 1 per cent. over 5 per cent. per annum paid in Dividends to the Shareholders. House, Coal, and Gas found.
The person appointed will be required to give security.
Applications, with two recent testimonials, should be forwarded to the undersigned on or before the 14th day of February, 1894.
JAMES MORGAN,
Solicitor.
Wiltshire and Dorset Bank Chambers,
Cardiff.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

WANTED, to purchase, Gas Carbon, delivered at nearest Station to Gas-Works, in quantities of not less than 4 tons.
Address, stating price per ton and quantity, No. 2318, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS AND WATER COMPANIES AND MANAGERS.

AN ASSOC.M.INST.C.E. having an extensive experience in GAS and WATER WORKS' DESIGN and ERECTION, now Chief Assistant in a large Gas-Works and Engineer to several small ones, having designed and erected a THREE HUNDRED and a ONE HUNDRED MILLION GAS-WORKS complete, besides several small ones, also ENLARGED many other Works, including NEW LIFTS to EXISTING GASHOLDERS, REGENERATIVE SETTINGS, &c., would be pleased to VISIT WORKS and ADVISE on their EXTENSION or ALTERATION, making SPECIFICATIONS, DRAWINGS, ESTIMATES, and superintend erection if desired.

SPECIALITIES.

Any EXTENSION or ALTERATION to GAS or WATER WORKS. ASSESSMENT of Gas-Works. New HOLDERS, TANKS, ROOFS, PURIFIERS, or FILTER-BEDS. TELESCOPING or adding FRESH LIFTS to EXISTING HOLDERS.
REGENERATIVE SETTINGS, for SMALL GAS-WORKS, without Excavations. SAVING 20 PER CENT. in first cost, renewals, and working.
Address "BOZ 9, Gracechurch Street, LONDON, E.C.

SCRUBBER for Sale, 6 feet diameter, with Special Staircase, Gallery, House, Connections, &c., complete. Made by Messrs. C. & W. Walker. In good condition.
Apply, by letter, to No. 2333, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—The following second-hand GAS PLANT:—
Round STATION METER (6-inch Connections).
9-inch STATION GOVERNOR.
KORTING STEAM-JET EXHAUSTER. Capacity 5000 cubic feet per hour.
One 6-inch FOUR-WAY VALVE.
Two 6-inch RACK-VALVES.
One 8-inch RACK-VALVE.
LIFTING GEAR for Purifier Covers.
Apply to W. MURRAY, Manager, Gas-Works, Limited, UTTOXETER.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals,
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore, Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

ALWAYS a Buyer of Spent Oxide, Tar and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

GOLD MEDAL, 1892.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 187).
Telegrams: "HUTCHINSON BROS., BARNSLEY."

ROUND Station Meter, by Porter and Co. of Lincoln, FOR SALE (3-inch Inlet). Cheap.
Apply SHIPYARD, RUTHERGLEN, N.B.

TAR.

THE Gas Committee of the Belfast City Council invite TENDERS for the Purchase of the TAR made at their Works, for a term of Three, Five, or Seven Years, commencing on the 1st of July, 1894.
The present annual make of Tar is about 1,350,000 gallons.
Conditions of Contract and other Particulars may be obtained from the Manager of the Gas-Works.
Tenders, on office forms, must be delivered on or before the 21st of February, addressed to the Town Clerk, Town Hall, Belfast, and endorsed "Tender for Tar."
The Committee may not accept the highest or any tender.
JAMES STELFOX,
Engineer and Manager.
Belfast Corporation Gas-Works,
Jan. 24, 1894.

Now Ready, Cloth Bound, Price 3s. 6d., Post Free,

THE ROYAL COMMISSION on the METROPOLITAN WATER SUPPLY.

— 1892-3. —

Report of the Evidence (reprinted from the JOURNAL), with Comments on the Inquiry, and the Commissioners' Conclusions and Recommendations.

LONDON: WALTER KING, 11, BOLT COURT FLEET STREET, E.C.

RAMSGATE CORPORATION.

(GAS AND WATER DEPARTMENT.)

THE Gas and Water Committee invite TENDERS for about 53,000 FIRE-BRICKS, (various sizes and shapes), and 10 tons of CLAY.

Tenders to be sent in on or before Ten a.m., on Monday, Feb. 12, 1894, addressed to the Chairman of the Gas and Water Accounts Committee, Hardres Street, Ramsgate, endorsed "Tender for Fire-Clay Goods."

Specification and full Particulars on application to

WILLIAM A. VALON, Engineer.

SHEFFIELD UNITED GASLIGHT COMPANY.

EFFINGHAM STREET STATION.

TO IRONFOUNDERS, ETC.

THE Directors of this Company invite TENDERS for the supply of RETORT FITTINGS, including Hydraulic Mains, Ascension-Pipes, Buck-Staves, Floor Plates, &c., for 80 Mouthpieces.

Drawings may be seen and Bill of Quantities, with Form of Tender obtained, upon application to the Engineer, Mr. Fletcher W. Stevenson.

Sealed tenders must be delivered by post, addressed to the undersigned not later than Saturday, Feb. 3, endorsed "Tender for Retort-Fittings."

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Jan. 19, 1894.

THE Gas Committee of the Leeds Corporation solicit TENDERS for the supply of FIRE-CLAY RETORTS, FIRE-BRICKS, FIRE-BRICK LUMPS, and FIRE-CLAY.

Particulars as to quantity, with Forms of Tender, may be obtained from Mr. Lupton, Gas Department, Municipal Offices, Leeds.

Tenders, addressed to the Chairman at the above address, endorsed "Tender for Fire Goods," will be received not later than Wednesday, the 14th of February next.

The lowest or any tender will not necessarily be accepted.

COLNE AND MARSDEN LOCAL BOARD.

(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for a THREE-LIFT TELESCOPIC GASHOLDER and WROUGHT-IRON ANNULAR TANK, 100 feet diameter.

Also for Three PURIFIERS, 24 ft. by 14 ft. 6 in., complete with Valves and Connections.

The Drawings, Specifications, and Forms of Tender can be seen at the Engineer's Office, Gas-Works, Colne, on and after Monday, Feb. 5, 1894.

The tenders must be sent to the undersigned on or before Feb. 28, 1894.

HY. SIMMONDS,
Engineer and Manager.

Gas-Works, Colne, Lancs.

THE Middleton Corporation are prepared to receive TENDERS for the following Articles required at the Gas-Works, during the ensuing Year: WET and DRY GAS-METERS, TUBES, and FITTINGS, RETORTS, FIRE-BRICKS and FIRE-CLAY, and LIME, delivered at the Gas-Works, Middleton (free of carriage).

Further Particulars may be obtained from Mr. Duxbury, Gas Manager.

The Corporation do not bind themselves to accept the lowest or any tender.

Tenders, addressed to the Chairman of the Gas Committee, to be delivered at my Office on or before Wednesday, the 14th day of February, 1894, endorsed "Tender for Meters," "Tubes, &c.," "Retorts," "Fire-Bricks, &c.," or "Lime," as the case may be.

FREDERICK ENTWISTLE,
Town Clerk.

Town Hall, Middleton,
Jan. 26, 1894.

TO RETORT AND FIRE-BRICK MANUFACTURERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for RETORTS, FIRE-BRICKS, BLOCKS, and FIRE-CLAY required at their Gas-Works during the current Year.

Forms of Tender may be obtained from Mr. T. O. Paterson, C.E., Gas Engineer, Gas-Works, Thomas Street.

Tenders, sealed, and endorsed "Tenders for Retorts, &c.," to be sent in to me not later than Five o'clock in the afternoon of Friday, the 2nd day of February, 1894.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
Jan. 22, 1894.

HORNSEY GAS COMPANY.

NOTICE is hereby given, that the ORDINARY GENERAL MEETING of the Shareholders of this Company will be held at the Offices of the Company, No. 63, Chancery Lane, in the County of Middlesex, on Friday, the 16th day of February, 1894, at Four o'clock in the afternoon precisely, to receive a Report from the Directors, declare Dividends, elect two Directors and an Auditor, and transact the Ordinary Business of a General Meeting.

The Transfer Books will be closed on the 2nd of February until after the General Meeting.

By order of the Board,
S. J. WILLIAMS,
Secretary.

Offices: 63, Chancery Lane, W.C.,
Jan. 27, 1894.

THE GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that a HALF-YEARLY ORDINARY GENERAL MEETING of the Proprietors in this Company will be held at this Office on Friday, the 9th day of February next, at Twelve o'clock (noon) precisely, to transact the usual Business, including the declaration of a Dividend for the Half Year ending the 31st day of December last, and to elect Directors and Auditors in the place of those who will at such Meeting go out of office in compliance with the Company's Acts or Schemes of Amalgamation.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Jan. 24, 1894.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is hereby given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Bridge House Hotel, London Bridge, in the Borough of Southwark, on Wednesday, the 14th day of February next, at Two o'clock in the afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st of December last, to declare a Dividend, and to elect two Directors and one Auditor in the place of those retiring by rotation.

The Transfer Books will be closed from the 31st day of January until after the meeting.

By order,
FRANK BUSH,
Secretary.

Offices: 709A, Old Kent Road, S.E.,
Jan. 22, 1894.

Now Ready, Price 15s., Limp Cloth, the Thirteenth Yearly

ANALYSIS OF THE ACCOUNTS

OF THE

Metropolitan Water Companies,

Chelsea, East London, Grand Junction, Kent, Lambeth, New River, Southwark and Vauxhall, and West Middlesex—showing the Capital, Income, Expenditure, Profits, and Dividends per Million and per Thousand Gallons of Water supplied; the proportion of Expenditure and Profits to gross Income; and the Income, Expenditure, and Profits per House, &c., supplied for the year ended December 31, 1892, or March 31, 1893, together with the quantity of Water supplied, the estimated daily quantity supplied for domestic and other purposes, the quantity supplied per head of population, &c., &c., for the year ended December 31, 1892.

Compiled and arranged by

ALFRED LASS, F.C.A.

LONDON:

WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,
FITTER.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The

WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.

Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**

The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

TROTTER, HAINES, & CORBETT,

Brettell's Estate

FIRE-CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUM S, TILES, and every description of FIRE-BRICKS.

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SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

COKE BREAKERS,

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New Design, with two Cutting Rollers, making less Breeze than their old pattern.

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CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

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FOR GAS, WATER, AND STEAM.

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For **FIRE-BRICKS,** the most durable for **GAS-FURNACES,**

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Gas Companies are solicited to try Samples of the

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BLACK BED GAS COAL.

Prices and Analysis on application.

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RAVENSTHORPE, NEAR DEWSBURY.

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CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

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ANALYSIS AND PRICES ON APPLICATION.

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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,

COAL OWNERS, NEWCASTLE-ON-TYNE;

OR

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21, JOHN STREET, ADELPHI, LONDON, W.C.

PATENT STOP-COCK WITH LOCKING ARRANGEMENT

Opinion of

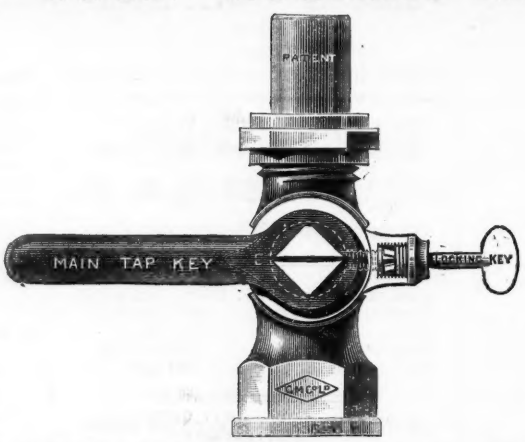
THOS. NEWBIGGING, Esq., M.Inst.C.E.,

5, Norfolk Street, Manchester, Oct. 9, 1893.

Messrs. WORMALD BROS., ECCLES, MANCHESTER.

GENTLEMEN,—I have examined the STOP-COCK (for gas and water), with your PATENT LOCKING ARRANGEMENT, and think very highly of it. It is simple, efficient, and inexpensive, not liable to get out of order, or to be tampered with. In all cases of temporary discontinuance of the supply of gas from any cause, the use of the Patent Locking Arrangement would be of great advantage, in saving the annoyance and expense, as well as the danger of leakage, in disconnecting the meter from the service-pipe. I should anticipate a large demand for the Stop-Cock, when its obvious merits are brought under the notice of those concerned. I am, yours truly,

THOS. NEWBIGGING, M.Inst.C.E.



Opinion of

J. HEPWORTH, Esq., M.Inst.C.E.,

Gas-Works, Carlisle, Jan. 13, 1894.

Messrs. WORMALD BROS., ECCLES, MANCHESTER.

GENTLEMEN, — I have had your STOP-COCKS, with PATENT LOCKING ARRANGEMENT, in use for some time past, both in the Gas and Water Departments. In the Gas Department, it has proved itself useful in cases where it was necessary to temporarily discontinue the supply of gas; and thus obviated the removal of the meter, or the stoppage of the supply in any other way. We have also found the Taps to be of considerable advantage when attached to gas-cookers and gas-fires, and much waste and annoyance have been prevented by their use. If you care to refer anyone to me, I shall be glad to answer any inquiries.

Yours faithfully,

J. HEPWORTH, M.Inst.C.E.

The above STOP-COCK is now in use in many of the leading Towns, and is giving perfect Satisfaction.

FOR PARTICULARS APPLY TO

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AGENTS:

THE GAS-METER COMPANY, LIMITED, LONDON, OLDHAM, and DUBLIN.

AGENTS:

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NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

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LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

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OXIDE OF IRON.

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Analysis: 12,600 feet of 19-candle gas per ton.

Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

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Special Bricks for Intense Heats.

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CASTINGS AND EVERY REQUISITE FOR GAS-WORKS.

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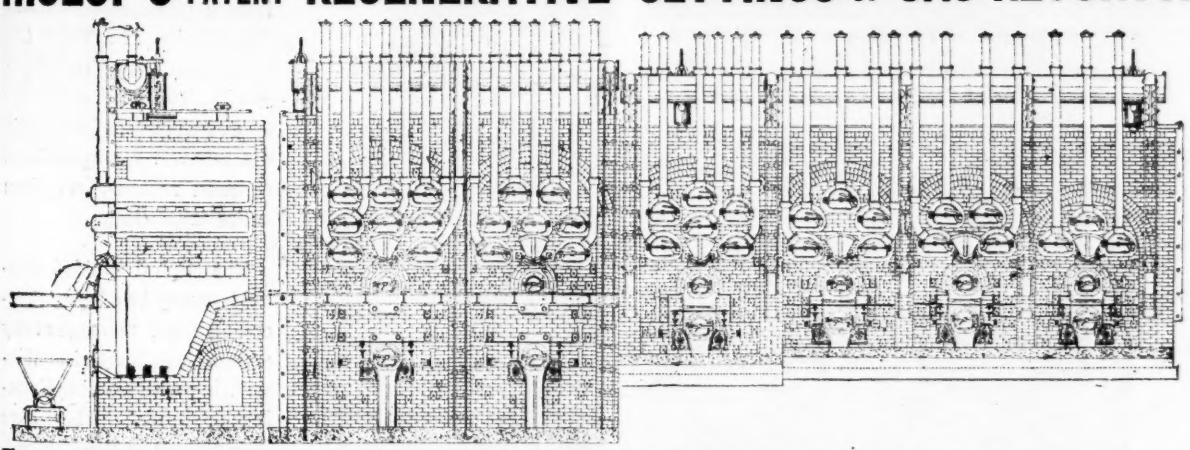
☞ Retort Setters sent to any part of the Kingdom.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN VERY EXTENSIVELY ADOPTED THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Chief Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

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MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
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FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
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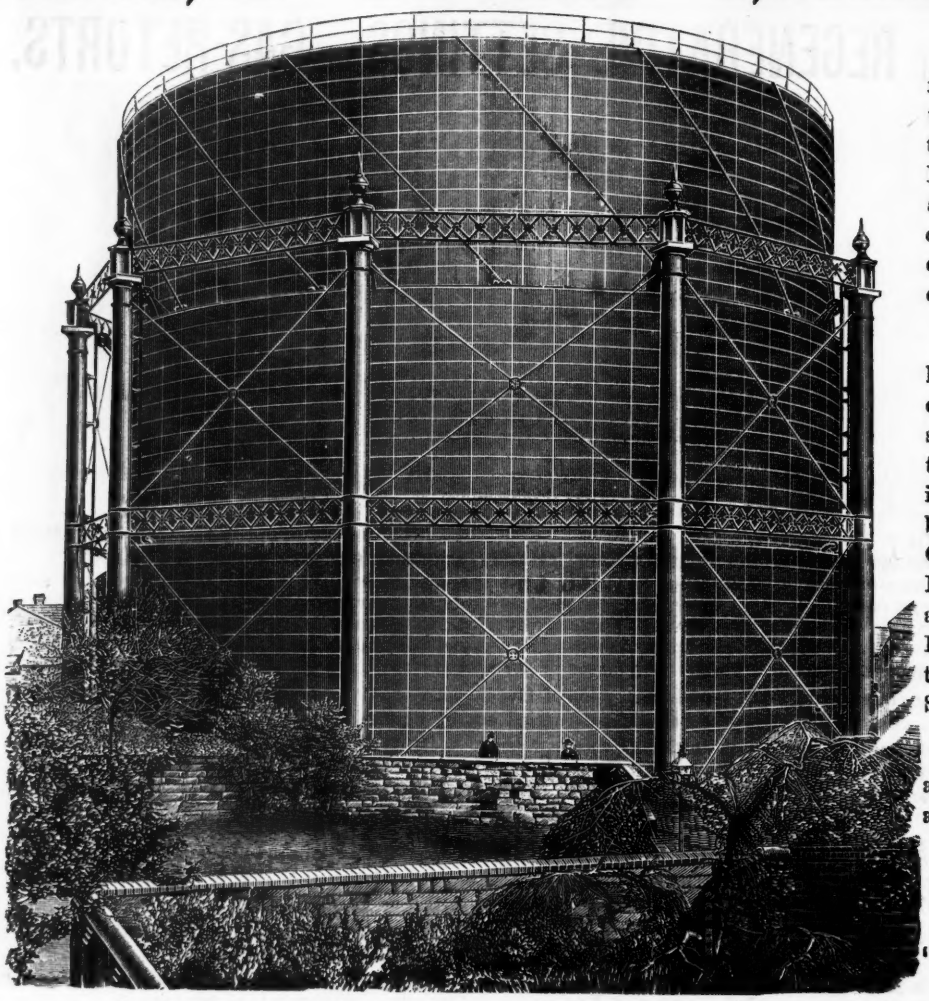
R. & J. DEMPSTER, Limited,
GAS PLANT WORKS,
NEWTON HEATH, MANCHESTER.
SOLE LICENSEES OF
SPIRAL GUIDED GASHOLDERS.



This illustration is taken from a photograph, showing the addition of a Third Lift to an ordinary Telescopic Holder, 102 ft. diameter by 56 ft. deep, which has been in constant use for upwards of eighteen months, and given entire satisfaction.

The Spiral Guided Gasholders may be adapted to increasing the storeage of any style of Gasholders without interfering with existing Framing or Tank. They have been erected in Brick, Stone, Concrete, Cast and Wrought Iron Tanks, and undoubtedly are the steadiest under Wind Pressure, in addition to being the safest and strongest in Snow-Storms and Frost.

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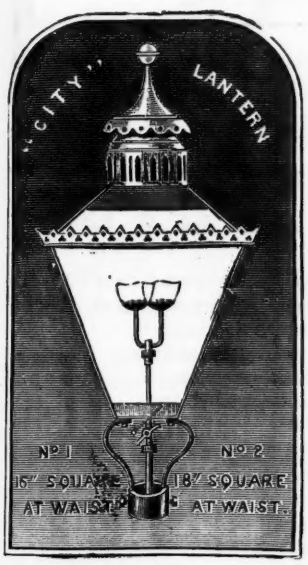
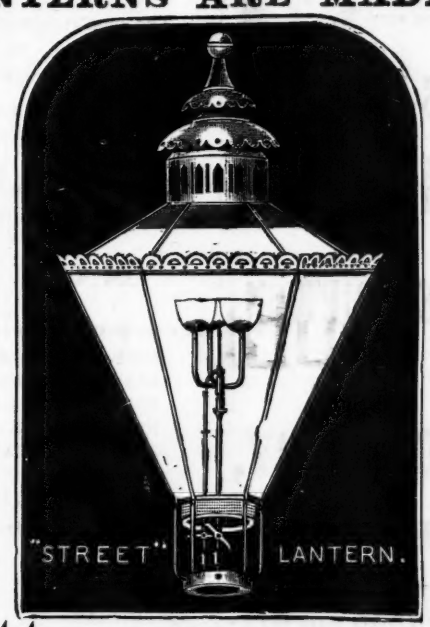
From 30 to 1100 Candle Power.

They are suitable for Gas of every Candle Power.

ALL OUR LANTERNS ARE MADE OF COPPER.





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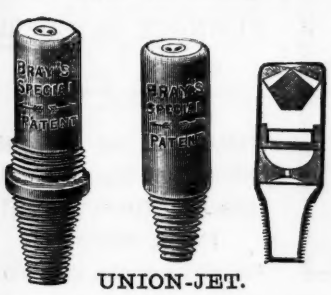
Are the best in the Market for general use, and are very moderate in price.

It is not unusual to see the ordinary Burner yielding less than half the light that Bray's "SPECIAL" would yield with the same consumption of Gas.

Gas Managers should try them on consumers' fittings; and they would see at once how to compete more effectively with the Electric Light.



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A. G. GLASGOW. M.E.,
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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
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IMPROVED
Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

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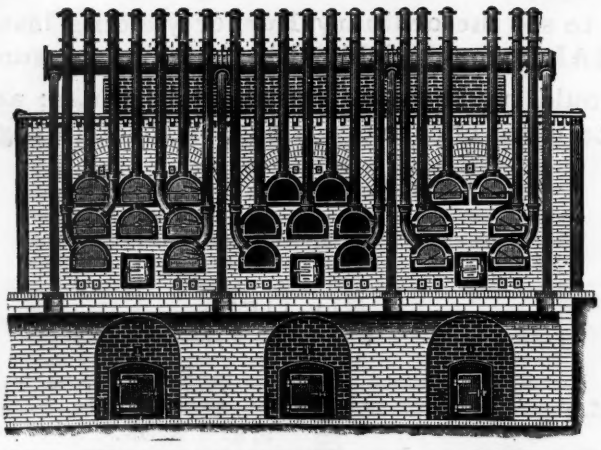

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REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

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ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

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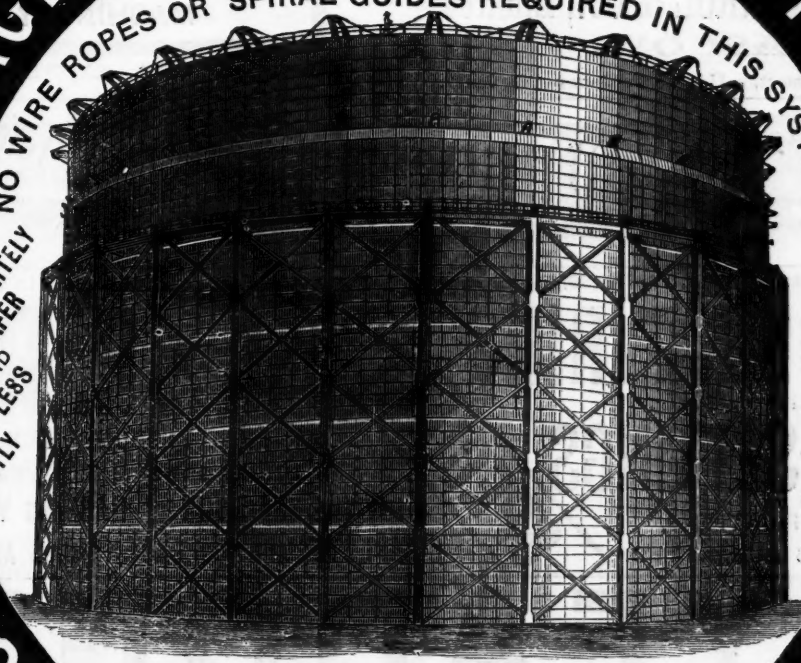
THE LARGEST GASHOLDER IN THE WORLD.

CAPACITY 12 MILLION CUBIC FT.

GASHOLDERS OUR SPECIALITY

NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.

INFINITELY SAFER AND FAR LESS COSTLY THAN ROPES OR SPIRAL GUIDES.



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IT HAS SIX LIFTS 30 FT. DEEP EACH AND IS 300 FT. DIAM.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

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TELEGRAPHIC "GAS, LEEDS."

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The Work published in 1879 by the late Mr. Stevenson is still on sale.

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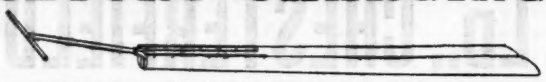

Scoops supplied with or without handles, and of any dimensions or shape required.

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Patent Automatic Machinery

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Full Particulars may be obtained from the Sole Makers,

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See Illustrated Advertisement, p. II. Centre of JOURNAL for Jan. 2.

STOURBRIDGE RETORTS AND FIRE-BRICKS.

BEST QUALITY.

KING BROTHERS, STOURBRIDGE.

[See Illustrated Advertisement, Jan. 2, p. 41.]

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GAS PURIFICATION.

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Purity and Uniformity of Quality Guaranteed.

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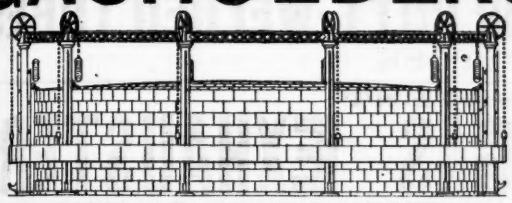
Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.
ESTABLISHED 1836.

HENRY BALFOUR & CO.,
LEVEN, FIFE,
MAKERS OF
GASHOLDERS



PRESSURE-REGULATORS FOR GASHOLDERS (See "JOURNAL" Dec. 20, 1892.)
FOUR-WAY VALVES,
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The Climax of Regenerative Gas Lighting!!

THE
"VERTMARCHE"
A 280-CANDLE POWER
PLAIN IRON LAMP,
CLASS A— 55/-
LIGHT for LIGHT
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RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

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GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas purposes.
ADDRESS CHIEF OFFICES:
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UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
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AND ALL KINDS OF GAS-WORKS APPARATUS.
SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S 'PATENT' GAS MAIN SYPHONS.
AGENTS FOR
ATTERTON'S PATENT APPARATUS for CHARGING RETORTS.

THE DEIMEL GAS-LAMP.

Absolutely the Cheapest, Simplest, and most Economical Lamp before the Public.

Price of **Bracket Lamp, from 13s.**

Suitable for Suspension, or can be fixed to the ordinary Bracket in place of Burner.

Price of **Suspension Lamp, from 21s.**

Consumption 6 and 9½ cubic feet respectively.

Proprietors: THE DEIMEL LIGHT COMPANY, LIMITED,
86, GRAY'S INN ROAD, W.C. Works: PORTPOOL LANE.
LIBERAL DISCOUNT TO GAS COMPANIES.

J. & W. HORTON
ETNA WORKS,
SMETHWICK,
NEAR BIRMINGHAM
(Established 50 Years),
PATENTEES
AND
MANUFACTURERS
OF

IMPROVED GASHOLDERS AND BOILERS

and Manufacturers of every description of
Gas Apparatus,
Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

Drawings, Specifications, and Estimates supplied.

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

FOR ANY PURPOSE.

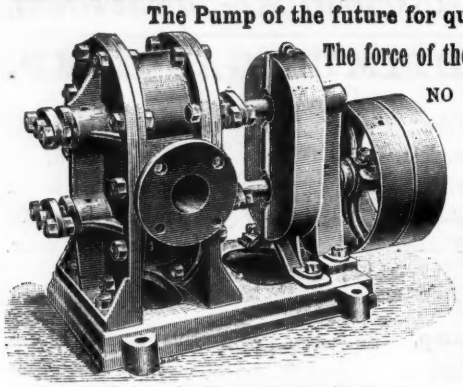
JOHNSON'S PATENT

DRUM PUMP AND GAS EXHAUSTER.

The Pump of the future for quickly and economically moving large bodies of Water.

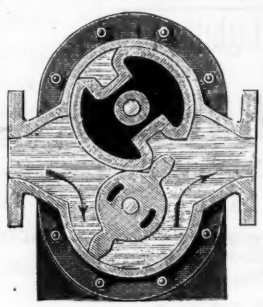
The force of the Piston Pump with the capacity of the Centrifugal combined.

NO SLIDES OR FRICTIONAL WORKING PARTS.



As supplied to the Harrogate Gas-Works for Pumping Gas Liquor.

NO PRIMING.



NO VALVES.

As supplied to H.R.H. the Prince of Wales for Pumping Gas Liquor at his Sandringham Gas Works.

DRUM ENGINEERING COMPANY,

Hydraulic and Pneumatic Engineers, **55, ATHOL ROAD, BRADFORD.**

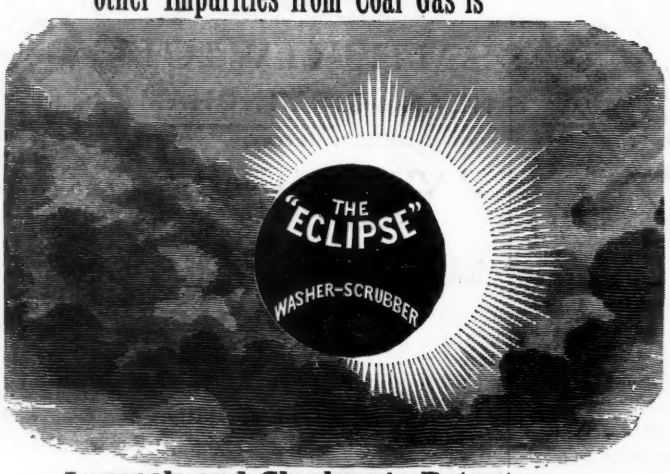
CLAPHAM BROTHERS, LIMITED,

ESTABLISHED 1837.

The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas is

KEIGHLEY, YORKS.

WELLINGTON, NELSON, & MARKET ST. WORKS.
Telephone No. 2235.
Telegraphic Address: "CLAPHAM BROTHERS Keighley."



Laycock and Clapham's Patent.

The Patent Wooden Balls thoroughly break up the Gas; give an immense amount of freshly-wetted Surface; and do not clog or increase back pressure.

Whilst the Gas is passing through and amongst the Balls, it is continually showered upon by the contents of Buckets.

The Shaft Revolves in Improved Bearings, and all Workings are accessible.

REPAIRS AND TROUBLE REDUCED TO A MINIMUM.

MAKERS OF

PURIFIERS,

With Lutes Cast and Planed Joints.

CONDENSERS,

VALVES,

MAINS,

RETORT-FITTINGS.

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